ISSN 0144 3674

# Computer Age

FEBRUARY 1981 ISSUE 15 60p

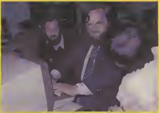
● Zoo Story ● Personal computers
● PILOT Interpreter
● UNIX operating system ● Expert Systems ● Medicine
● That first computer

# MicroCentre introduce . . . . . . CROMIX

Cromix is Cromemco's new multi-user multi-tasking high speed disk operating system It is modelled on Bell Labs Unix operating system widely available for the popular PDP-11 range of mini-computers Cromix is capable of using hard disks and floppy disks in a 1 to 6 user environment At present it supports multi-user Structured Basic Fortran IV Ratfor Macro Assembler and screen editing

## Efficient

The internal structure of the Cromix operating system optimises input/output buffering making disk-intensive execution more than twice as fast as most other micro-computer operating systems For instance Cromix usually runs CDOS programs faster than CDOS by utilising a simulator which intercepts CDOS operations and translates them into more efficient Cromix function calls



**Ed Hall is one of Cromemco's top systems designers. Here he puts Cromix through its paces using a System Three in a 4-user configuration providing up to 63k per terminal.**

## Flexible

Users can maintain individual sets of directories and redirect I/O to achieve system flexibility Cromix supports single and double sided floppy disks and up to three hard disks These features provide a new standard of system performance seldom found even in larger mainframe operating systems

**Norman Rouxel MicroCentre's Managing Director illustrates a point about the use of Cromix to simulate a PDP 11 system running Unix in time-sharing mode**

## Cromix features

- Hierarchical directories
- Compatible file device and inter process I/O
- Large number of operating system buffers
- Disk addressing to over 1000 Megabytes per spindle
- Arbitrary number of directories, sub-directories and files
- Maximum file size is disk capacity or 1000 Megabytes, whichever is smaller
- Asynchronous processes
- User definable system features
- Executes CDOS calls as well as Cromix calls

## For C *Cromemco*... call the experts

MicroCentre
Tel: 031-556 7354

**LEADING UK DISTRIBUTORS**

Complete Micro Systems Ltd ,
30 Dundas Street
Edinburgh EH3 6JN

# Xitan: South Coast Leaders in Microcomputer Support Application and Service

**Xitan in Business**

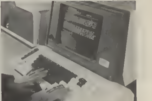
Xitan provide cost effective computer support for wide ranging business organisations from low entry level, stand alone systems for the smaller business to integrated multiuser/multitasking systems

**Xitan in Science and Research**

Xitan support scientific and research users in universities colleges government and independent research establishments with comprehensive practical experience embracing hardware system, and applicational software

XITAN SYSTEMS

23 Cumberland Place
Southampton SO1 2BB
Tel 0703 38740



**Cromemco SHARP North Star Horizon comart**

# Outstanding value. Superb support.

Commodore produce Britain's number one microcomputer. But we don't stop there. We also insist on providing comprehensive support throughout our national dealer network.

Our dealers can examine your needs and demonstrate which hardware and software will suit you best. Their trained engineers are always at hand and a 24 hour field maintenance service is available.

Ask your local dealer to tell you more about the following Commodore Services.

**The Commodore PET**

The Commodore PET computer range covers everything from the self contained unit at under £500 to complete business systems at under £2,500.

**Commodore Business Software and Petpacks**

Our software range covers hundreds of applications. Business software includes Sales and Purchase Ledgers, Accounting, Stock Control, Payroll, Word Processing and more. In addition over 50 Petpacks are available covering such titles as Strathclyde Basic Tutorial, Assembler Development System, Statistics, plus our Treasure Trove and Arcade series of games.

**Commodore Approved Products**

Compatible products of other manufacturers with Commodore's mark of approval are also available.

**Commodore Courses**

Commodore offer a range of residential training courses and one day seminars. An excellent start. And when you have installed your system the PET User's Club Newsletter can keep you informed of new ideas and latest developments.

## LONDON AREA

Advanced Management Systems EC2 01 638 8319
Centralex London Ltd SE13 01 318 4213
Computer Sales & Software Centre Ltd ILFORD 01 554 3344
Crown Microcomputer Shop HARROW 01 863 0633
Da Vinci Computer Shop EDGWARE 01 952 0526
Henderson Bennett SE25 01-654 5609
Home and Business Computers E12 01-472 5107
L&J Computers NW9 01 204 7525
Logic Box Ltd SW1 01 222 1122
Merchant Systems Limited EC4 01 353 1464
Micro Computer Centre SW14 01 878 3285
Sumlock Bondain Ltd EC1 01 250 0505
Sumlock Bondain Ltd EC4 01 626 0487

## HOME COUNTIES

Millhouse Designs Ltd ALTON 84517
HSV Microcomputers BASINGSTOKE 62444
MMS Ltd BEDFORD 40601
Amplicon Micro Systems Ltd BRIGHTON 562163
T&V Johnson (Microcomputers Etc) Ltd CAMBERLEY 20446
Wego Computers Ltd CATERHAM 49235
Catamen Ltd COLCHESTER 76811
Amplicon Micro Systems Ltd CRAWLEY 26493
S M G Microcomputers GRAVESEND 55813
South East Computers Ltd HASTINGS 426484
Brenmoor Data Services Ltd HATFIELD 60980
Alpha Business Systems HERTFORD 57425
Commissioned Business Systems Ltd HIGH WYCOMBE 40116
Kingsley Computers Ltd HIGH WYCOMBE 27342
Brent Computer Systems KINGS LANGLEY 65056
Computopia Ltd LEIGHTON BUZZARD 376600
South East Computers Ltd MAIDSTONE 681263
J.R. Ward Computers Ltd MILTON KEYNES 562850
Sumlock Bondain (East Anglia) Ltd NORWICH 26259
T & V Johnson (Microcomputers Etc) Ltd OXFORD 721461
C.S.E. (Computers) READING 61492
Slough Microshop SLOUGH 72470
Business Electronics SOUTHAMPTON 738338
H S V Microcomputers SOUTHAMPTON 22131
Super Vision SOUTHAMPTON 774023
Symtec Systems Ltd SOUTHAMPTON 38868
Stuart R Dean Ltd SOUTHEND ON SEA 62707
The Computer Room TUNBRIDGE WELLS 41645
Orchard Computer Services WALLINGFORD 35529
Photo Acoustics Ltd WATFORD 40698
Microchips WINCHESTER 68055
P P M Ltd WOKING (04867) 80111
Oxford Computer Systems WOODSTOCK 812838

## MIDLANDS & S HUMBERSIDE

C B S Consultants BIRMINGHAM 772 8181
Marchant Business Systems Ltd BIRMINGHAM 706 8232
Micro Associates BIRMINGHAM 328 4574
Peach Data Services Ltd BURTON-ON-TRENT 44968
Jondane Associates Ltd COVENTRY 664400
Davidson Richards Ltd DERBY 366803
Allen Computers GRIMSBY 40568
Caddis Computer Systems Ltd HINCKLEY 613848
Machsize Ltd LEAMINGTON SPA 312542
Arden Data Processing LEICESTER 22255
Roger Clark Business Systems Ltd LEICESTER 20455
Lowe Electronics MATLOCK 2817
A J R Office Equipment Services Ltd NOTTINGHAM 286647
Betos (Systems) Ltd NOTTINGHAM 48108
PEGA Computer Systems Ltd RUGBY 65756
Walters Computer Systems Ltd STOURBRIDGE 70811
Systems Micros TELFORD 460214

## YORK & N HUMBERSIDE

Microprocessor Services HULL 23146
Holdene Ltd LEEDS 459459
South Midlands Communications Ltd LEEDS 782326
Yorkshire Electronics Services Ltd MORLEY 522181
Computer Centre (Sheffield) Ltd SHEFFIELD 53519
Hallam Computer Systems Ltd SHEFFIELD 663125
Holbrook Business Systems SHEFFIELD 848466

## NORTH EAST

Dyson Instruments DURHAM 66937
Currie & Maughan GATESHEAD 774540
Elfton Ltd HARTLEPOOL 81770
Fiddes Marketing Ltd NEWCASTLE 815157
Intex Datalog Ltd STOCKTON-ON-TEES 782193

## S WALES & W COUNTRY

Radan Computational Ltd BATH 318483
C S S (Bristol) Ltd BRISTOL 779452
T & V Johnson (Microcomputers Etc) Ltd BRISTOL 422061
Sigma Systems CARDIFF 34869
Reeves Computers Ltd CARMARTHEN 32441
A.C. Systems EXETER 71718
Micro Mart GLOUCESTER 411810
Micro Media Systems NEWPORT 59276
J M Computer Services Ltd NEWQUAY 2863
A.C. Systems PLYMOUTH 260861
J A D Integrated Services PLYMOUTH 62616
Business Electronics SOUTHAMPTON 738248
Computer Supplies (Swansea) SWANSEA 290047

## N WEST & N WALES

B & B (Computers) Ltd BOLTON 26644
Tharstern Ltd BURNLEY 38481
Megapalm Ltd CARNFORTH 3801
Catlands Information Systems Ltd CHESTER 46377
Catlands Information Systems Ltd WILMSLOW 527166

## LIVERPOOL

Aughton Microsystems Ltd LIVERPOOL 5487788
Stack Computer Services Ltd LIVERPOOL 933 5511

## MANCHESTER AREA

Byte Shop Computerland MANCHESTER 236 4737
Cytek (U K) Ltd MANCHESTER 8724082
Professional Computer Services Ltd OLDHAM 061 624 4065

## SCOTLAND

Gate Microsystems Ltd DUNDEE 28194
Holdene Microsystems Ltd EDINBURGH 668 2727
Gate Microsystems Ltd GLASGOW 221 9372
Robox Ltd Glasgow 221 5401

To Commodore Information Centre
360 Euston Road London NW1 3BL Tel 01 388 5702
Please send me further information about the Commodore PET
Name
Position
Address

Local dealer (if known)
Do you own a PET YES NO

commodore

Cover: Zoo Story
by [illegible]

# Editorial

## GETTING INTO COMPUTERS

What did you do during the Work, daddy?

Well, son, I got into computers.

Oh. I didn't realize people got into computers. I thought computers were trying to get into people. Ergo sum.

Not in those days, son.

Well, dad, how did you get into computers?

It wasn't easy, son. I was a school leaver with 3 O Levels and people kept telling me I'd only have job security if I got into the new technology. Trouble was, back in those days, when people could almost starve if they didn't have a job, nobody would give you a job unless you had experience, and you couldn't get experience unless you had a job. Thing was, employers — that's what they were called — wouldn't take on a trainee for fear that he'd slink off to a rival outfit as soon as he was trained.

But surely some of the rival's trainees slunk off to them.

Ah yes, it would take a child to see that, son. It's amazing the lengths adults will go to not to see the obvious. Fact was, back in those days of profit maximisation, as it was called, what employers wanted was computer staff ready trained, but the last thing anyone wanted to see was public money — remember money? — going to support the educational system that produced them. And with all that unemployment and all, they were employing graduates to do coding.

Coding? We do that in the third form.

So what chance did a school leaver with 3 O levels have?

Well, Dad, how did you get into computers?

The hard way, son, the hard way. By the way, what do you hope to do when you grow up?

Well, Dad, if I get my A level Renaissance Man, I thought I might try to become an all round person.

Yes, that's not a bad idea, son. There's a bit more of a call for all round people now than there was in my day.

**Anthony Esgate**
*Deputy Editor*

Page 74

Page 75

# Contents

FEBRUARY
1981
ISSUE 15

**DETERMINISM** GEOFF SIMONS 4
Are people programmed?

**DRAWING A PARALLEL** BRIAN HEFFIN SMITH 7
Parallel graphics

**BUBBLE MEMORY BLOWS IN** PETER KRASS 8
Bubble bubble — Coming at us on the double

**THE RISING LAND OF THE RISING SUN** BRUCE EVERISS 11
Market share — the retail imperative

**ZOO STORY** PENNY FLOOD 13
Computer aided animal medicine

**SOFTWARE LESSONS FROM HISTORY** ANTHONY PAYNE 16
Computer assisted learning

**EASY ADMISSION** CA SPECIAL 19
Computer assisted registration of Students

**PERSONAL TO THE PROFESSIONAL** GAVIN HAINES 22
Occupational computing

**MAINSTREAM AND MICROSTREAM** MARTIN BEER 25
Connections and influence

**TIME FOR RETAIL TO WAG THE INDUSTRY** MARTIN BANKS 28
The Computer Retailers Association

**A PILOT PROJECT** MICHAEL BOLLEY 31
The second part of the PILOT interpreter project

**BRAND NEWS** MICROSPY and ANTHONY ESGATE 35
• Applications • Systems • Services • Courses • Literature

**A FORTH COMMENTARY** GIL FILBEY 50
Filbey comments on the following article

**A FORTH CHEQUEBOOK PROGRAM** EDWARD J. MURRAY 52
A FORTH application

**UNIX ON MICROCOMPUTERS** ERIC FOXLEY 54
A highly regarded operating system as implemented on micros

**EXPERT SYSTEMS** ROB COE 57
Can computers acquire knowledge and experience?

**INTELLIGENT SCRIBES** BORIS SEDACCA 60
Pen Plotters

**COMPUTERS IN GENERAL PRACTICE** TIM BENSON 63
Micke

**A MEDICAL MONITOR** PATRICK DIXON 66
For the general practitioner

**BOOK REVIEW** 68

**PAXTON BUSINESS DESK** RICHARD WALLER 69
A software package review

**THAT FIRST COMPUTER** JOHN MACLEAN 72
How to evaluate suppliers' proposals

**GRANTS AND CONSULTANCY** B I M 74
The **BRITISH INSTITUTE OF MANAGEMENT** page

**OVERSKILL AND SHORTFALL** LYNDA KING TAYLOR 75
The Manpower Services Commission's valiant fight against ignorance and inertia

**LETTERS** 78

**GUIDE TO ADVERTISERS** 80
A handy reference and index combined

---

**Editor**
Michael N. Shoman

**Deputy Editor**
Anthony Esgate

**Columnists**
Martin Banks
Brian Heffin Smith
Royal [illegible] An

**Correspondents**
*Technical: Victor Nicola*
*Applications: Penny Flood*

**Editorial Advisers**
Dr. Martin Beer, Liverpool University
Prof. Martin Healey, Cardiff University
Gil Filbey, South Bank Polytechnic
Neil Ha[illegible]

**Advertisement Manager**
Vanessa Buckton [illegible] 01 928 6394

**Advertisement Executive**
Robert Greave 01 928 6394

**Office Manager**
[illegible]

**Secretary**
[illegible]

**Publisher**
John Freshwater

**Design Consultant**
David G. McFarlane

**Typesetting**
[illegible]

**Artwork**
Gillian

**Editorial Offices**
4 [illegible] London SE1
Telephone 01 928 6394

Computer Age [illegible] Distribution by Moore Harness Limited [illegible]

# Determinism

*The author puts forward a contrasting viewpoint to that of F W Lukey's article (Issue 14) and the conclusion of the extract from Douglas Hofstadter's Gödel Escher Bach (Issue 24)*

The development of computer technology has forced us to re-examine the role of man in society. And the nature of people themselves is also open to a new scrutiny: the growth in computer potential – particularly in such areas as machine creativity and intelligence – is throwing unexpected light on what it is to be human. There are surprising social ramifications in this – in such traditional areas as communication, education and penal philosophy.

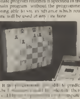
It is significant that artificial systems are increasingly able to perform as if they were reflective and animate. This circumstance immediately invites the converse notion – that animate systems are themselves akin to automata in important respects. It is no accident that generalised cybernetic principles apply equally to biological and artificial systems. This highlights the conflict between the two views of man that have run through philosophy from the earliest times.

On the one hand, man is autonomous, possessed of independent volition, an apparent link between material and supernatural worlds. In this view, man is free in some crucial metaphysical or spiritual sense. This is the notion that underpins traditional morality and such theological doctrines as the Fall, redemption and salvation. On the other hand, it is possible to view man as a highly complex machine, totally governed by discoverable physical laws. Here there is no scope for independent volition. Man is wholly constrained by the properties of matter. People make choices but there is an important sense in which the choices are not free, nor, it follows, is any aspect of the behaviour which issues from decision making. Part of the impact of computer development is in helping to resolve the dispute between these two important views of man.

Even the early first generation electronic computers had a decision facility. With the development of software and the provision of enhanced intelligence via microelectronics, the decision facility has become more flexible and more useful. But the facility has been there from the beginning. In one simple interpretation the computer decision facility allows program instructions to be obeyed in a *non-sequential* fashion. Program instructions are obeyed sequentially until an instruction is encountered which causes a jump to another section of the program. The jump may occur following, say, inspection of a particular data store: such a jump is said to be conditional. It is important to be clear how such a facility represents a decision making capability.

The computer may or may not jump following interpretation of a conditional jump instruction. It all depends upon whether the condition is met. An instruction held in program address 6203 may say 'proceed to address 9739 if the contents of register A are less than 10'. The normal implication is that if the register A contents are not less than 10 the computer will proceed to obey the instruction held in program address 6204, ie a counter will simply count on by 1 to specify the next instruction to be obeyed.

The contents of register A may be fluctuating continuously, depending on their source. For example, the contents may represent a parameter being monitored in a chemical process plant, in a warehouse or in an airline reservations system. Different parameter values may require different control procedures to be implemented, ie it may be required to call up appropriate sections of computer program. The provision for calling up appropriate program routines is specified in the main program, without the programmer being able to say in advance which routine will be used at any one time.



It th[illegible] to predict wh[illegible] there [illegible] computer de[illegible] This program [illegible] required [illegible] desired [illegible] facility [illegible] appropriate [illegible] until a particular [illegible] example [illegible] particular [illegible] sense [illegible] sure. The main program and the subsidiary routines are written and put into operation well before the specific parameter changes are instituted. It is thus essential that the computer be able to select a suitable course of action according to particular circumstances. The provision for doing this is established in the computer program, but the way the provision will be exploited by the computer cannot be known until the particular combinations of circumstances occur.

## Choice

It is possible to argue that the computer decision making facility is closely analogous to the choice mechanism in human beings. At a superficial level there are obvious similarities between the decision making activities in human and artificial systems: circumstances are encountered which demand selection of an appropriate course of action. The question remains: to what extent can such a decision making facility be identified with what is called 'free will' in human beings? One way to examine this question is to consider the common objection to regarding free will and computer decision making as strictly analogous.

The main objection focusses on the traditional idea of human freedom: people are free to choose – they can exercise independent volition whatever their social background, education and personality. Their choice may be constrained by social and other factors but there is always a central non-deterministic core in the human nature that preserves the distinction between human beings and automata. It is easy to see the attraction of such a doctrine. Above all, it enshrines the idea that people are special and so feeds human vanity.

But it is difficult to see how the doctrine can be made intelligible. It requires not only that a distinction be made between deterministic and non-deterministic elements in human nature but that the non-deterministic element be conceived in such a way that it can allow the required quality of 'freedom'. It is characteristic of this freedom that it is supposed to enhance human dignity, give grounds for a moral definition of responsibility and legitimise certain theological ideas. In fact it can be shown that none of this is tenable.

It is important to understand the implications of a non-deterministic interpretation of human decision making. What this must mean is that a choice is made in the total absence of causal influences (cause is a deterministic concept), ie the choice must be random – it cannot be influenced by any factor, for instance by a person's education, knowledge or moral considerations. Hence it is obvious that a non-deterministic interpretation of decision making can in no way serve to underpin an enhanced view of human dignity: it can only represent our acts as capricious and non-responsible. This means that we can only escape from a totally deterministic view of man at the price of admitting that substantial parts of our behaviour are outside our control (control is a deterministic concept). But clearly this will not satisfy those who wish to believe in some concept of free will.

A consequence of this analysis is that human choice, like machine choice, is most profitably interpreted within a deterministic framework. Any interpretation of free will that is to be both intelligible and useful must be consistent with a causal view of human nature. This seeming paradox is forced upon us by analysis of the deterministic/non-determin-

## Essay

[illegible] of human nature and by appreciation of the flexibility and scope of choice mechanisms in artificial systems

It is sometimes argued that although it is true that computers have an effective choice capability this is provided by an external agent the programmer Such an argument is intended to show that computer choice is derivative not *real* choice in the human sense But the same argument *mutatis mutandis*, can be applied to human choice (and thereby to free will) The programming of every individual is provided in all its initial fundamentals by forces outside the individual's control by genetic endowment and by the influence of environment on the individual's early growth

There are theories about detailed human programming (eg Chomsky's concepts regarding language receptivity) but we do not need to argue for any specific doctrine It is obvious at a general level that our genetic programming is species specific (and some would say despite the feminists sex specific) We are genetically predisposed to a certain development certain behaviour certain responses etc by virtue of the biochemistry that defines our species and an individual place within it If a person subsequently uses independent volition (free will) to influence his own development or environment he is bound to use his pre-existing programming to do so Otherwise he could not act in any coherent fashion

It follows that a tight analogy can be drawn between computer choice (decision making) and human choice (free will) This analogy can be delineated in a number of discrete propositions

1 Both human and artificial systems can be programmed to exercise choice in changing circumstances
2 Choice mechanisms in human and artificial systems can only be comprehended within a deterministic framework (Non-deterministic interpretations when properly understood are not useful and do not enhance our view of what is to be human )
3 The analogy is reflected in the use to describe both human and artificial systems of a common language employing such words as 'choice', 'decision making' 'selection' etc (The specifically human reference of such phrases as 'free will' and 'independent choice' is easily accounted for by the conventional moralistic and theological uses of such symbols )
4 Neither human nor artificial systems are self programming in the initial stages (Any subsequent self programming presupposes an existing program )
5 Whatever the flexibility and subtlety of human choice activity the same can, in principle be accomplished by artificial systems

A number of consequences flow from the decision to acknowledge a tight analogy between choice mechanisms in human and artificial systems Most importantly we are obliged to scrutinise areas where we are traditionally eager to make *moral* judgements In such areas as penology education and human relationships in general we are accustomed to judging on a moral basis At the same time we are prepared to recognise the concept of *mitigation* The above analysis seems to establish that there is *always* mitigation however undesirable or disagreeable the behaviour It does not follow that certain conventional responses (eg punishment) are not appropriate when a criminal is apprehended What does follow is that the reason for the response must be defined with care it must act as a causal element in the social framework. It is not acceptable for example, to inflict pain (mental or physical) for its own sake to cause a 'debt to society' to be paid

It should now be clear that aspects of computer technology of software in particular – are highly relevant to an analysis of human behaviour in society I would expect some people to find this an odd conclusion I well remember my own surprise in finding many years ago that a proper appreciation of conditional jump orders in the Ferranti Argus order code was relevant to an understanding of muggers delinquent children and war criminals ●

● *Geoff Simons is the Chief Editor of NCC Publications Oxford Road Manchester*

# BASIC COMPILER FOR COMMODORE SYSTEMS

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible] WEDGE [illegible]
- [illegible] I/O programming, eg DELAY SETBIT MOVE etc
- [illegible] interrupt routine
- [illegible] ports etc
- Full logical file handling
- Compiling speed [illegible]

[illegible] and debugger Editing environment and language [illegible] Produces ready to run 6502 Machine Code

Detailed Manual £7.50 inc VAT Compiler 3000 series [illegible] VAT
8000 series [illegible] VAT

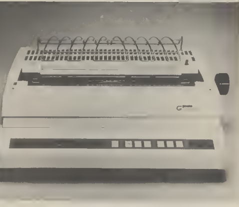
[illegible] Computer Systems

5 Oxford Street Woodstock Oxford OX7 1TQ Telephone Woodstock (0993) 812838

geveke
electronics

# New MODEL 630

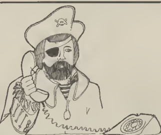
LETTER QUALITY PRINTING AT REALISTIC PRICES



- Interchangeable Metal/Plastic Print Wheels
- Automatic Bi-directional Printing
- Word Processing Options
- Diablo Quality and Reliability
- Paper Handling Accessories

FOR INNOVATIVE DISTRIBUTION TO OEMs

*Call us..* Geveke Electronics Ltd. RMC House. Vale Farm Rd. Woking. 04862 71337



# DRAWING A PARALLEL

*Parallelenigmatics*

> 'A student pursuing a Master's degree in advanced blindingly obvious things began a lecturette to the sullen plotter '

We stood around the click clacking plotter in silence as it drew out the lines whose endpoints were being passed to it from the Computer a few feet away Once in a while one part of the Calcomp* shot across to another part of itself, to pick up a felt tip pen of a different colour

Members of the group of watchers periodically peered close to the plotter s moving bar and penholders or smoothed the paper near the pen s trace causing static electricity to crackle in the dry atmosphere Twice heads and fingers had to be jerked away from the more unexpected sudden motions of the device

Eventually it stopped drawing The paper was retrieved and examined

*You bastard* muttered the psychologist in italicized frenzy whilst the electronics engineer merely thumped the Altair computer which blinked one of its red lights and said OK

A student pursuing a Master s degree in advanced blindingly obvious things began a lecturette to the sullen plotter

Parallel lines he said parallel lines proceed alongside each other at a constant distance apart heading in the same general direction They do not veer towards one another They do not meet ever And they do not his voice trailed off

I felt it my duty as the most senior staff person in the room to conclude his unimpeachable structures with a pedagogically appropriate phrase They do not sodding cross one another like the ski tracks of of Christ I couldn t *think* of anything fetal humiliation lousy lines Reagan rhetoric

Parallel lines are two or more of those things you think you need more often than you really do like square roots I mean the cheapest calculator from Woolworths will usually have a square root sign on one of its keys But before calculators one did not – did one? – habitually go around striking one s fist to one s forehead and exclaiming My *God* I wish I could extract the square root of 137 21 Well alright a bit a bit

Same with parallel lines Until one day a person from Graphic Information phoned I could tell it was an internal call so of course immediately became suspicious It s like being a seedy ex-pirate who runs a pub now but people still want the odd boat rowing with silent rowlocks and dark lanterns

Is that Brian Smith?

Who wants to know? (eh me arty?)

I hear you can er you can draw *lines*

Someone took a sharp intake of my breath I felt my chest move It must have been me (Hey that s quite good isn t it?) (Sorry )

Lines you say Oo told 'ee such a thing?

Folks say there s none can draw a line as smooth nor as fast as Master Smith And in colours

Colours you say? Well – maybe I can maybe I can t Colours is it?

They say as ow the numbers go in that box o yern and comes out as lines fine as the lines on a tabby cat s tail

Well that they do Or can do But lines you see *lines* they don t come cheap Dots now I can do you some dots pretty as you ever did clap eyes on Lines – ow can I put it not wantin to offend like? lines is time and time is

Precious Yes I ve eard But I know as ow you might want to consider my proposition, given as theses lines b aint exactly for me but for a young girl, ails from Pole-land Magda by name And seem too as ow if you don t agree I ll make your name Mud around these parts stead of Cap n Incredible

Well I never said I *wouldn t* nor that I couldn t Why don t ee come round to my den this evening *We ll* see what *lines* can be drawn We ll meditate on it over a bottle of Leibfrau-grog

It is one of the weirdest computing problems A student wanted to design bus-maps for Scottish islands and needed parallel lines where the routes ran together for a while Parallel lines are difficult to draw You try it and see I mean curving ones sometimes live

---

*For a brief overview of pen plotters see Boris Sedacca s article this issue

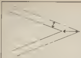


Figure 1

abreast neat enough for printing

In outline the problem is well-defined You digitise an initial line into the computer the road let s say that all the lines must follow Then the progam calculates sets of co ordinates for the other parallel lines and the plotter draws them out Easy? No

Given that the curved lines are in fact because digitized – made up of small straight lines you can of course find the equation of each line and from that deduce the equation of some line parallel to it

The problem is where do these straight lines meet? The maths is peculiar Do you find where the equations coincide or draw circles round each point whose radii are the distances the lines should be apart? Or do you use angles and distances? You'll see (Figure 1) that the distance between the two points is different from the standard inter line distance are they still parallel?

## Discourse

As each solution seemed about to succeed and then failed we got more and more confused I tried thinking sideways Suppose you drew the first line then magnified it or viewed it with enhanced perspective, as if closer No that won t work on real roadmaps And simple shifts won t either not for complex curves

Could we draw it out by hand then pretend the computer had done it? But they d want to see it going

Oh for the good old days of chess automata with midgets concealed where gears purported to be Damn microtechnology Perhaps if we bought a Christmas programmable tank from Selfridges?

Angles were the best bet but whilst they were fine for simple parts of the curves the lines would otherwise suddenly switch sides zooming inside the initial line to follow there for a time later to bunch up outside again as the value of some cosine changed from nothing to one

Or worse going berserk on the far side of the paper miles from the line like a dog on the run Parallel Lines Liberation Front! PLLF! Try to imagine the final frenzy as the lines betrayed our trust in their inherent decent good nature got mardy (as we used to say in Leicestershire sulky) and slyly loped all across the infinite flat surface of their blood[illegible] world

Gradually, we got the tricks and traps right Eventually even I could digitise a rough circle a polygon and little phantom green lines would follow round from nearly start to just-before finish But the lines converged They were not parallel

A question how would you have done it? (We did it! – see fig 2) A point INT(10*A+ 5) is likely to be much more accurate than 10*INT(A), which is obvious now but wasn t then

And hence a simple lesson Do the big things right now then try to get it right rather than get it right then do the big things

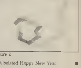


Figure 2

A belated Happy New Year ■

●The author is at the Royal College of Art Kensington Gore London

# INNOVATIVE
# TRS-80 SOFTWARE

- ✓ **Business**
- ✓ **Programming Aids**
- ✓ **Personal**
- ✓ **Custom**
- ✓ **Games**
- ✓ **Utilities**

**7 Years Microprocessor Experience!**

Please send a large SAE for 44p for our TRS 80 software list, or add £1 85 for the list in a binder

**A.J.HARDING (MOLIMERX)**
**MOLIMERX Ltd.**
28 COLLINGTON AVENUE BEXHILL-ON SEA E SUSSEX
TEL (0424) 220391 TELEX 86736 SOTEX G FOR A J HARDING

BARCLAYCARD
VISA

# Bubble Memory Blows In

Something to remember bubble memory is here to stay

It wasn't always such a certainty Especially after the Wall Street pundits praised the new technology to the skies and nobody seemed to care But after a start that was slower than even the grumpiest of bears expected the U S market for these devices is beginning to look well viable So far the single biggest application seems to be in portable terminals most notably those made and sold by Texas Instruments

The other star in the bubble memory game is Intel the big chip supplier Other players include Rockwell National Semiconductor Motorola and IBM Most of today's market belongs to TI but that could easily and quickly change

Today that market is worth about $18 4 million So says Venture Development Corporation a Massachusetts research group They say this figure will reach about $226 million by 1985 an average growth rate of about 65 percent

Bubble memory devices were first built by researchers at Bell Laboratories in 1966 But it was not until the mid 1970s that they were sold in consumer and OEM products At that time both the vendors of these devices and the various industry experts analysts and hangers on were wildly predicting an explosive bubble memory market

Venture Development's Edward Ross who supervised the group's recent update of its 1977 report on bubble memory products says Just a few years ago bubble memories were the darlings of Wall Street. In 1977 we came out and said that Wall Street's figures were overblown But even our estimates were too high Why? Well, for one thing, TI and Rockwell were giving price estimates for their product that were ten times too high

Kent Logan semiconductor stock analyst for New York brokerage Goldman Sachs adds, "Ultimately bubble memory will be a large market But the product was introduced prematurely and as a result it hasn't gone anywhere It may become a significant market but probably not so very big

Tony Langham stock analyst for New York house Paine Webber Mitchell Hutchins says Remember Intel is a $1 billion company Is bubble memory going to make a significant dent in this? Probably not

Yet another voice on the Street, James Mendelson a junior analyst with Morgan Stanley, says It's an important field no question And as the costs of bubble products come down the technology becomes a reasonable alternative to removable media, especially floppy disks

Just what is bubble memory and how does it work? First 'bubbles' are actually cylindrical magnetized volumes less than a sixteenth the diameter of a human hair in a thin film of crystalline magnetic material about a quarter-inch square The polarity or magnetic direction of the bubble is opposite that of the film which makes up the chip Bubbles are created when a uniform magnetic field is applied perpendicularly to the chip The bubbles then become a series of bits – the units of digital communication

Data is read in a unique way Bubbles are *duplicated* within the chip One of the two bubbles travels around what is called the storage loop, thus retaining memory while the other proceeds to the output track and is read by a detector

Although Bell Laboratories says it now has a one-inch square bubble chip that can store 8 megabits of information the largest commercially available chips are of the 1 megabit variety

While bubble memory may compete with specific performance characteristics of other memory devices it will not replace them Its primary application is to augment other memories

Its benefits are that it can store comparatively huge amounts of data it is non volatile – that is, data is retained when power is removed and it is compact highly reliable and resistant to shock vibration humidity radiation and temperature extremes

On the negative side bubble memory chips have slower access speeds than do semiconductors But they are still faster than other magnetic media like tapes and disks

This unique technology often defines its uses Because the chips are shock-resistant and have a wide temperature range, they are ideal for portable terminals, which are used by both business and the military TI, for instance, now markets a line of portable terminals using bubble chips that have become quite popular

*Time* magazine, for example, has outfitted about 20 of its travelling correspondents with 765 terminals Each unit weighs about 17 pounds Copy is stored in the terminals bubble memory and is fed back to the home office over telephone lines *Time's* reporters got a lot of use out of the units during the 1980 presidential elections as they followed the candidates from sea to shining sea

Other applications include use in word processing systems, telecommunications equipment and in process control applications In other words wherever non-volatile program or data storage is needed

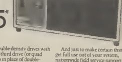
Venture Development's Ross explains, 'Bubble memory has some very specific uses – for one it's very reliable It maintains data for a very long time – perhaps up to a century, we really don't know But it does have a slow transfer rate and a relatively slow access time

Surprisingly, the first bubble memory product in the field has held up extremely well" Ross adds 'Usually a product has a lot of bugs at first, but not bubble memories The vendors are simplifying the product and have worked out some of the problems – like how to connect with other systems – and it's beginning to look like a viable business The companies are now accepting orders for future delivery – a good sign ■

---

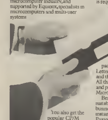
* *See also [illegible] article in Issue [illegible] Dr [illegible] article in Issue 9*

# A Word Processor, Report Writer, Mailing System, Data Base Manager, and a Computer all for £1995*



Yes, we are offering all this with our SERIES 5000 5" floppy-disc system for the incredibly low price of £1995 *

Not only do you get a powerful Z-80A system on the S-100 bus built to high quality standards by Industrial Microsystems, one of the longest-and best-established companies in the microcomputer industry, and supported by Equinox, specialists in microcomputers and multi-user systems



You also get the popular CP/M Operating System (from Digital Research), a 12-slot bus for easy expansion, a Z-80A CPU for powerful performance, 2 serial and one parallel interfaces, 64KB of dynamic RAM with in-built error detection capability, and dual 5" double-density drives with the option of a third drive (or quad capacity drives in place of double-density) in the same cabinet Additionally, there is the Turbocharger option providing both enhanced disc capacity, disc performance and diagnostics And if even greater storage is required we can supply 8" floppy drives and cartridge disc drives

A powerful system for the computer-user and system developer – and one with eventual access to OS/2000, the Industrial Microsystems networking system

And for the office or business user we are including as standard a powerful Word-Processing package (Wordstar), a Mailing and Letterwriting package (Mail Merge) and the Datastar Data Base Manager All these packages are widely accepted and professionally written by Micropro International

Being CP/M based, the system with suitable configuration will also run the business software developed by (for instance) Graffcom, Peachtree, Paxton, etc

It will also run a wide range of languages – Basic, Cobol, Fortran, Pascal, APL, Algol, C Lisp, and Fords and will support a wide range of add-on S-100 devices, such as floating point processors, Prestel interfaces, speech synthesisers, digitisers and plotters, etc

And just to make certain that you get full use out of your system, nationwide field service support is available at a modest extra cost

*add VAT and the terminal and printer of your choice at the costs shown

| | |
|---|---|
| **Series 5000 with 64KB Dynamic RAM, dual 5' double density drives, CP M Operating System, Wordstar, Mail-Merge and Datastar** | **£1995** |
| **The same system with quad drives in place of the double density drives** | **£2230** |
| **Add-on double density drive** | **£290** |
| **Add-on quad drive** | **£405** |
| **Peripherals** | |
| **Televideo 912C VDU** | **£595** |
| **Elbit 1920X VDU with Wordstar keyboard** | **£895** |
| **OKI Microline 80 printer** | **£595** |
| **Texas 810 150cps printer** | **£1450** |
| **NEC Spinwriter RO Word processing printer** | **£1850** |

All prices exclude VAT, carriage, training and installation and are subject to our standard terms and conditions

**OEM dealer and educational enquiries welcome.**

**EQUINOX**
COMPUTER SYSTEMS LIMITED
Kleeman House, 16 Anning Street,
New Inn Yard, London EC2A 3HB
Tel 01-739 2387/9 & 01 729 4460

# The Rising Land Of The Rising Sun

*In these writings Everiss hopes to present a view of the microcomputer industry as seen by a retailer. While this is a different view from that of the user he hopes that the observations made are of general interest.*

**O**ver the next twelve months there will be more changes in our industry than over the last twelve months. The changes will benefit the consumer enormously. There will be a wide range of better products at lower prices available from more shops. That this will happen is inevitable. What will be surprising is the magnitude of the change and the reason for it – the coming of the Japanese. The important factor to the Japanese is market share and because of this their marketing techniques will be different from those used by existing manufacturers.

> 'The important factor to the Japanese is market share'

Their first technique is to look after their retailers, whereas the suppliers of American equipment treat their retailers with supreme arrogance and the suppliers of British kit are worse still. By looking after their retailers the Japanese manufacturers create brand loyalty and this encourages the retailer to look after the customer.

An example of the care taken is in dealer training. The better trained a dealer is the better he can look after his customer. The suppliers of British and American equipment normally give no dealer training – the few that do supply training that is inadequate, expensive or both. In contrast Sharp have provided their dealers with a succession of excellent free one-week courses that have set a new standard in the industry. It is almost worth being a Sharp dealer just to be able to send staff on a course.

Their second technique is to use centralised distribution. The U.K. retail market has been traditionally weak for foreign products because we have the best organised retail industry in the world with multiple outlets having centralised control and distribution. All it takes is a couple of centralised retailers to handle microcomputers, say Currys and Dixons, and instantly there are twice the number of computer stores in the country. The inevitable explosion in the number of computer retailers will be even more significant because of the professionalism that these big companies will bring to the marketplace. Existing retailers will find it harder to compete and the increased competitiveness can only be to the customer's advantage.

Their third technique is only to sell tested products. The testing is being done in their home market of Japan. Any Western visitor to a Japanese computer store would be amazed at the proliferation of products that we have yet to see. These products cover the full marketplace from small hobby and introductory machines to big business systems, with most manufacturers producing a range of products covering this marketplace.

The Japanese microcomputers are in general good and exceptionally well made and reliable. Many of them incorporate systems software bought from America and thus 'State of the Art'.

The U.K. market place is not without its problems for a manufacturer. The main problem is the domination by just three products, namely, Apple, Pet and Tandy. All the other products on the market place put together have less market share than any of these. Potential purchasers tend to consider only these machines even though there are often vastly more suitable products at better prices. The dominance of the big three will be difficult to break. Other problems are the U.K. retail tendency to sacrifice service for discount and the almost total scarcity of people who know about microcomputers and who are commercially able.

Let's now take a look at some specific manufacturers.

*SHARP* have established an enviable reputation for reliability with their PET lookalike the MZ80K. The PC 1211 pocket computer is genuinely innovative and the new PC 3200 looks like being by far the best big microcomputer on the market.

*NEC* have made their name with the Spinwriter printer which is (as always) well made and reliable. They are following this up with the PC 8001 personal computer which is Z80 based and features a considerably enhanced Microsoft BASIC.

*SEIKO* (the well known manufacturer of chronometric devices) has entered the market with the Seikosha GP80 printer which offers traditional Japanese quality at £250.00. Waiting in the wings they have a microcomputer already sold in Japan and imminent in the U.K.

> 'the U.K. retail tendency to sacrifice service for discount'

*PANASONIC* have a range of microcomputers – the larger ones have yet to be successful in this country but the RL H1000 hand-held computer is fabulous – like an enhanced PC 1211, it has peripherals available including T.V. interface, RAM expansion, printer, I/O driver, ROM expansion etc.

Others that are on the way include:
Hitachi MB 6880 (BASIC MASTER)
Teac PS 80
Sord M 100
Panatacom PFC 15
Sanyo PHC 1000

As you can see, we are in for a very interesting year. I will bring you more news on these products and others as it becomes available. Next month I hope to write a general overview of the retail marketplace in this country. ■

*■ Bruce Everiss is founder of Microdigital, which is now part of the Lasky group.*

# Software for SUPER BRAIN

(other CP/M™ machines supplied)

## LANGUAGES

### MICROSOFT INC.

| | | |
|---|---|---|
| MBASIC | Interpreter | £195 |
| BASIC | Compiler | £215 |
| FORTRAN | Compiler | £240 |
| COBOL | Compiler | £375 |

### MICROFOCUS

| | |
|---|---|
| †CIS-COBOL | £445 |
| CORAL 66 | t.b.a |

### WHITESMITHS

| | |
|---|---|
| †C | £340 |
| †PASCAL (includes C) not yet available | £500 |

### RESEARCH MACHINES LTD

| | |
|---|---|
| *ALGOL 60 | £110 |

### MT microSYSTEMS

| | | |
|---|---|---|
| PASCAL | Compiler | £145 |

### VANGUARD SYSTEMS CORP

| | | |
|---|---|---|
| APL | Interpreter | £190 |

### tiny c associates

| | | |
|---|---|---|
| †tiny c | interpreter | £50 |

### DIGITAL RESEARCH INC

| | |
|---|---|
| †PL/I | £300 |

### OTHERS

| | |
|---|---|
| Multi FORTH (Creative Solutions) | £75 |
| PILOT | p o a |

## UTILITIES

| | | |
|---|---|---|
| *EDIT 80 | (Microsoft) | £50 |
| *MACRO 80 | (Microsoft) | £90 |
| FORMS II | for CIS COBOL | £100 |
| *BSTAM | (Byrom Softwear) | £80 |
| SUPERSORT | (Micropro) | £125 |
| HDBS | | t b a |
| MDBS | | t b.a |
| MICRO B+ | | £120 |
| MAC | (Digital Research) | £60 |
| ZSID | (Digital Research) | £60 |
| DESPOOL | (Digital Research) | £35 |
| DATASTAR | (Micropro) | £160 |

**MicroPeople Ltd.**

TEL: LONG EATON (06076) 69117

1 UNION STREET, LONG EATON,
NOTTINGHAM NG10 1HH

*10% discount on any two software orders exceeding £350*

*Manuals £10(*) or £20 except †*

Prices subject to change without notice

Trade Enquiries Welcome

## APPLICATIONS

### COMMERCIAL

| | | |
|---|---|---|
| MCS Ltd<br>OASIS III | Invoicing<br>Stock Recording<br>Sales Ledger | £1150 |
| | Purchase Ledger<br>Nominal Ledger | £950 |
| | Full Integrated System | £1960 |
| MEDIAN TEC | Payroll | £500 |
| ROGIS | Estate Agents system | £475 |
| | Stock Control system | £475 |

### WORD PROCESSING

| | | |
|---|---|---|
| MICROPRO | WORDSTAR | £250 |
| | with Mail-Merge | £320 |
| sba | MAGIC WAND | £200 |

### ENGINEERING

| | | | |
|---|---|---|---|
| MEDIAN TEC | Slope Stability Analysis | | £500 |
| | Portal Frame Plastic Analysis | | £500 |
| | Decide Concrete Design pkge | | £1500 |
| | Finite Element Beam Analysis | | £1500 |
| ENG ANALYSIS | Truss force program | | £35 |
| | Structural Finite Element | 2D | £50 |
| | | 3D | £75 |

## MISCELLANY

| | |
|---|---|
| CP/M User Group Library | £8 per disk |
| STATISTICS pkge | £100 each |
| MATH FUNCTION pkge | £150 both |
| MICROSTAT STATISTICS | £150 |
| SIMPLEX method LINEAR PROGRAMMING | £50 |
| EDUCATIONAL SOFTWARE | p o a |
| GAMES PROGRAMS | p o a |

● ● ● HARDWARE CORNER ● ● ●

**YES!** WE ALSO SUPPLY THE KIT

£1995
incl CP/M 2 2

£2400
dble sided vn.

Printers from
£400

MOST SYSTEMS under £5000 complete

Postage and Packing **FREE** on Cash With Orders

ADD V.A.T.
Despatched by RETURN whenever possible

Trademark info

SUPERBRAIN – INTERTEC DATA SYSTEMS CORP
CP/M – DIGITAL RESEARCH
Z80 – ZILOG INC

● DO NOT HESITATE TO CONTACT US FOR ANY REQUIREMENT NOT LISTED ABOVE ●

# ZOO STORY

One of the latest arrivals at London Zoo's animal hospital has neither fur, feathers nor scales. You can't pet it or feed it peanuts and it won't make your skin creep. It isn't even sick. It's a computer, a Codex CDX 68-4 with 64K memory and hard disks.

Like most of the inhabitants of the London Zoo the computer is of foreign origin, but there the similarity ends. No expeditions were sent all over the world to find a suitable specimen. On the contrary, Stephen Pugsley, the senior technician in the pathology department who was largely responsible for bringing the computer into the hospital, tried very hard to buy British but no British manufacturer was interested in the zoo project.

The new computer is going to be used to store all the hospital's clinical, pathological and publications records. Later it will be used for research and diagnosis. Incidentally, the Codex is not the very first computer to be used in the zoo – the accounts department has a PET and, yes, they've heard all the jokes, thank you!

There are an enormous number of records kept at the hospital, which does not only treat the animals from its own two establishments, Regent's Park and Whipsnade, but also those from other zoos in Great Britain, and privately owned exotic pets. Every year they carry out 800 post mortems and 700 new patients are admitted to hospital for treatment. This is in addition to all those who are long term patients. Every animal, dead or alive, has a record card made out for it. Under the old system, records were all filed by hand and kept in an old filing cabinet, which was beginning to burst at

Copyright: Zoological Society of London

*She had a bad kidney but she [illegible] at Whipsnade again*

[illegible]

[illegible] parative physiology. They all work very closely with hospitals, universities, veterinary colleges and other research establishments. Greater knowledge and understanding of the causes and cures of disease, especially in the fields of genetic disorders and cancer, can lead to improved treatment for humans as well.

In order to carry out its work effectively, the London Zoo had to find an efficient way to handle its vital information, one that would be quick and easy to access and safe from damage or prying eyes. The existing card system was clumsy and inefficient, but modern technology had an answer.

Stephen Pugley was interested in computers and he set out to find one.

As London Zoo is a charity, he had only a limited amount to spend. At first his budget was £2,000. During his search he discovered just what a jungle — and this isn't an animal joke — the computer market really is.

He now feels that there should be a code of conduct for computer sales persons. Too many of them, he says, are interested only in selling you their product, regardless of what you really need. Stephen, however, knew exactly what the Zoo needed. He also realised that he was not going to get it for £2,000, so, unlike many first time computer users, he patiently waited until he found the right system rather than being hustled to a decision by an aggressive salesman.

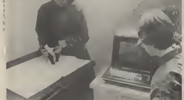
A short time later the Zoo was left some money in a will and Stephen's computer budget was upped to £5,000, which was still insufficient and does not, in fact, cover the cost of the hardware they now have. This time, when Stephen went shopping he was not just looking to purchase the hardware. London Zoo is a unique organisation and had a unique offer to make any supplier: if they would help with the hardware, the Zoo would give the necessary consultancy advice to develop a comprehensive veterinary package, the first of its kind in the world.

At first, Stephen felt that as the Zoo is a British institution they should buy the flag. He approached several British manufacturers but there were no takers, not even from companies who already have medical systems. So a British first, developed with British knowhow, had to be produced with American aid. Stephen met Peter Kear of Hawk Cramer at an exhibition. Hawk Cramer is the systems house and U.K. marketing agents of the American Codex. Hawk Cramer were definitely interested. They agreed to help with the hardware and now the two institutions are pioneering the world's first veterinary package. Veterinary packages for farms have been around for a while now, but they only deal with a limited number of diseases, brucellosis and mastitis for instance, affecting a small number of animals. The new Zoo system will be able to help in the diagnosis of a huge range of disorders in an enormous range of animals and offer advice on the suitable treatment. It's going to be invaluable to vets, zoos, game parks, colleges and so on, all over the world. It's got to be good because it has got the full weight of the London Zoo Animal Hospital behind it. The zoo's vets [illegible] well about [illegible] a recent list [illegible] included a chimp with dermatitis [illegible] starlings with parasites [illegible] a cheetah with a kidney [illegible] several parrots with tumours [illegible] privately owned and then [illegible] the results of [illegible] mishandling and a Siberian tiger [illegible] pneumonia.

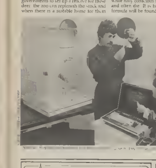
The installation [illegible] the [illegible] hospital comprises [illegible] central processing unit and a terminal which [illegible] and hard disks which [illegible] permanent [illegible] from Hawk Cramer. They don't have a printer yet but are happily [illegible] that somebody will give them one. "We've got a lot of friends out there," [illegible] Stephen sums it up. With all the records computerised, information can be called up in seconds rather than hours because early diagnosis can prevent death or, in extreme cases, an epidemic. Now when a gorilla comes in with a sore throat, it is both quick and easy to find out what happened the last time there was a case of the same thing. It's going to save a fortune in phone bills. Once, when European zoos had a problem that they could not solve, and they often do, they had to telephone and wait while somebody looked up the answer. Now they only have to wait for as long as it takes to summon the information to the screen.

The publications records is a gigantic bibliography of publications, at least the largest in Europe if not the world. Millions of words have been written on all aspects of zoology and more are added every week. Once, when you wanted to know who said what about tuberculosis in raccoons, you had to wade laboriously by hand through the bibliography. Now, just tell the computer what you want to read about and it will tell you almost at once where to go to find it. An additional benefit is that the highly trained vets can get on with their really important work and spend less time messing around in filing cabinets.

When the computer is ready to run research programs, the zoo has some interesting projects for it. One is the development of an ideal anaesthetic. At the moment, when a lot of deer are anaesthetised, some do not come round, although they were quite healthy at the



You don't ha[illegible] [illegible]ems to benefit from [illegible] outset. There is a particular reason why they want to find a better alternative very soon. A breed of deer in North Africa is becoming extinct. London Zoo however has established a breeding herd at Regents Park. While negotiations are underway with respective African governments to set up a reserve for these deer, the zoo can replenish the stock and when there is a suitable home for them many of the deer will be rehabilitated. They will have to be anaesthetised before they can be moved as animals who travel while fully conscious suffer terrible stress and often die. It is hoped that the right formula will be found before they do go back. The CDX 68.4 will have a big part to play there.


[illegible]

Peter Kear wrote the software for the zoo with a lot of help from Stephen. He finds it a great change and challenge after so long in business systems. Now he can talk of hormonal deficiencies and blood groups as easily as he used to discuss payroll and general ledger.

Stephen's plans for the computer are ambitious. He would like half a dozen terminals all situated in strategic parts of the hospital, the operating theatre, path labs, libraries, offices. All connected to a central computer which will be locked away in a dust free environment (hard disks do not like dust) and where its noise cannot get on anybody's nerves. Computer terminals in corridors could offer a security threat if the information could be accessed by anybody who was passing but Peter Kear's program takes care of that problem – the computer simply won't let anybody into the system unless they give it the secret password and as additional security the password when typed in does not appear on the screen.

So although the newcomer will never say Pretty Polly nor sit up and beg and certainly lacks the appeal of a baby panda, it does know a trick or two and everybody is very pleased that it is there. ■

• [illegible] correspondent of Computer Age and has written for The Guardian

ANGLIA COMPUTER CENTRE

MICROCOMPUTERS FOR BUSINESS,
EDUCATION AND HOME

FOR ALL YOUR BUSINESS, EDUCATION & LEISURE
COMPUTER REQUIREMENTS!!!

APPLE II and III
TRS-80
SHARP
NORTH STAR
HORIZON
TANGERINE
U K 101
NASCOM
VIDEO GENIE

+PRINTERS &
OTHER PERIPHERALS
BOOKS**
SOFTWARE*
MAGAZINES**
STATIONERY***
BUSINESS PROGRAMS
and
INDUSTRIAL CONTROL

WE ARE HERE!!!

88 St. Benedict's Street
NORWICH NR2 4AB
Tel (0603) 29652
24 hr. Answering Service

Memories

| | | |
|---|---|---|
| 2114 300ns | 1k x 4 SRAM | 2 25 |
| 4116 200ns | 16k x 1 DRAM | 2 61 |
| 2708 450ns | 1k x 8 EPROM | 3 60 |
| 2516-450ns | 2k x 8 EPROM | 7 20 |
| 2716 450ns | 2k x 8 EPROM | 7 20 |
| 2732-450ns | 4k x 8 EPROM | 18 00 |

Please add 50 pence for postage and packing
Please add 15% VAT to TOTAL cost of your order
Send SAE for price list

STRUTT LTD.

ELECTRONIC COMPONENT DISTRIBUTORS
MANUFACTURERS & SUB CONTRACTORS
to the ELECTRONIC INDUSTRY

3c BARLEY MARKET ST ,
TAVISTOCK, DEVON ENGLAND, PL19 0JF
Tel TAVISTOCK (0822) 5433/5548 Telex 45263

# Software: Lessons From History

*This article [illegible] in the field of computer-assisted learning materials development.*

'You have reached the River Somme. A much larger French army is hard on your heels. The crossing point is guarded on the far side by some 3000 French men at arms. Do you make a stand with your army's rear protected by the river, or do you fight your way across when the tide falls, hoping that it will rise again in time to cut you off from the main French force?

Your close friend has been inciting mutiny. Do you try him for treason, a capital offence, or take a more moderate action?

Most of your provisions are in a supply ship. Do you take the whole fleet through the straits of Magellan where winter conditions prevail all year round, or do you break up all but three of the ships in the fleet, distributing men, equipment and supplies between them?'

This is the essence of some of the decisions which face students running the computer simulations of Edward III's Normandy campaign (1346) and Francis Drake's voyage around the world.

> *'A decision to use the packages clearly has implications beyond their immediate use'*

The simulations in which small groups of second and third formers collectively assume the roles of Edward III and Francis Drake were developed at the Oriel Grammar School in Norfolk. The first program produced, CAMPAIGN (in 1976) was a slightly more modest version than the one currently in use. It deals with Edward's Normandy campaign from the time that the English army disembarked at St Vaast to the defeat of the French at Crecy. DRAKE followed in 1977.

Both programs were written in BASIC on an ICL 1903A mainframe computer housed in Norwich City College, and used via a teletype terminal connected by telephone. They were used in this way until the school acquired a Research Machines Limited 380Z microcomputer with dual mini floppy discs. CAMPAIGN was subsequently re-written for it because though the original was portable enough the variations in output line length meant that the output on the VDU was unsightly.

DRAKE and CAMPAIGN are role play decision making simulations, although they do contain a significant element of instruction. They are based on a linear model dealing with actual historical events where one is concerned with particular incidents, as opposed to being conceptual in approach.

Students take decisions on situations which faced the historical characters, basing them on information output to the terminal screen, or information contained in an accompanying booklet. The booklet, in the case of CAMPAIGN, includes battle plans and a drawing of the landscape viewed from the village of Crecy.

Both booklets contain maps on which the students plot their movements.

The DRAKE booklet also contains a 'Captain's Log' in which details of principal events are recorded. The combination of booklet and program has proved very successful, and not only in history packages. There is no graphics facility on the terminal; that available on the 380Z (we have low resolution graphics) compares very unfavourably with good drawings on paper.

The booklets contain a great deal of useful material, including system and simulation operating instructions, which cannot reasonably be incorporated into the programs. Since part of each booklet is completed by the students during the course of a run, they have, at the end of it, established a healthy set of notes. It is the opinion of the team working at Oriel that the booklets are important as a tangible reminder of what would otherwise be a transient experience.

Decisions are analysed by the computer and an evaluation, output for the user, discusses the merits or demerits of a particular action in the light of known historical events. In this way the students never lose sight of what is understood to have actually happened.

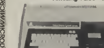
On the ICL mainframe, each program takes about thirty to thirty five minutes to run, and fits comfortably into a teaching period. CAMPAIGN, when run on the microcomputer, takes twenty to twenty five minutes. Either way, only one group of four students can expect to run a program during a single period. This means that a class of twenty eight with two periods of history a week will take three and a half weeks to complete the assignment. Theoretically it is possible to allow students to run the programs after school or at lunch time, but this is not always easy to arrange. The demands

MICRODIGITAL
82 + V
play
croll
SHARP
NOW YOU HOLD THE KEY!

# Video Genie

● **New low price**

## Amazing Value – compatible with TRS80 16K level 2



Microdigital [illegible] includes free delivery within [illegible] every machine is thoroughly tested by our engineering department before despatch.

The Video Genie is a complete computer system, requiring only connection to a domestic 625 line TV set to be fully operational; or if required a video monitor can be connected to provide the best quality display.

The system case contains the Central Processor Unit (CPU), 16 000 bytes RAM memory, the cassette system, a 12 000 byte operating system and BASIC Interpreter in ROM and a full size keyboard in a stylish case at a price that makes the Video Genie better value than some 'kit' computers.

**Applications**

The Video Genie System has many uses in all spheres of life, the easy to use BASIC language means that programs are easily written for specific applications and pre recorded program tapes are available in great variety.

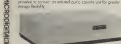
The system has great scope in the home, sophisticated games programs can introduce the computer age to all the family who can then progress to writing their own programs in BASIC or even machine code. Software is continuously being developed to aid home budgeting and education.

In a school or college the machine can be used with a large screen TV to allow a whole class to be taught at once.

The powerful Extended BASIC interpreter makes the solution of complex scientific problems simple and the graphics allow pictorial displays of results.

**Cassette Unit**

The Video Genie has an integral cassette system which can save information on standard tape cassettes. An interface is also provided to connect an external audio cassette unit for greater storage flexibility.



### Expansion

**The EG3013 EXPANDER (expansion unit)**

is designed to upgrade your VIDEO GENIE SYSTEM, from a personal computer to a powerful microcomputer system in the most flexible and inexpensive way. All resident interfaces are fully buffered to ensure reliability.

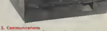
The Parallel Printer Interface will operate any printer which has Centronics standard parallel interface to provide hard copy printout.

**2. Mass Storage and Fast Access**

The Disk Controller Interface can handle up to 4 sets of mini floppy disk drives (compatible types as Shugart SA 400 and Pertec FD 200)

Storage options. i)Single side single/double track density 35/40/77 tracks.
ii)Double side drives can also be used provided their side select signals are modified. If using double side, the Disk Interface can only handle 2 drives instead of 4.

Disk Operating System options TRSDOS NEWDOS MICRODOS VTOS



**3. Communications**

The RS 232 C Interface (optional) can be connected to telephone modem or other form of carrier to provide data communication capabilities. Besides communications it can also be used to operate RS 232 C standard serial printers.

**4. Memory Expansion**

Memory capacity can be expanded from the basic 16K to 32K/48K by insertion of RAM CARD (not inclusive in the EG3013 EXPANDER package) into either one of the two remaining S 100 slots.

**5. S-100 Bus Expansion**

Optional S 100 Bus standard cards (such as controller cards) can be plugged into either one of the two remaining S 100 slots for further system expansion.

| Prices | Nett | Vat | Total |
|---|---|---|---|
| Video Genie Computer | 280 00 | 42 00 | 322 00 |
| EG3013 Expander with RS232 | 215 00 | 32 25 | 247 25 |
| EG3013 Expander without RS232 | 185 00 | 27 75 | 212 75 |
| 32K Memory Board S100 | 130 00 | 19 50 | 149 50 |
| 16K Memory Board S100 | 95 00 | 14 25 | 109.25 |
| Single Disk Drive | 215 00 | 32.25 | 247.25 |
| Dual Disk Drive | 410 00 | 61 50 | 471.50 |
| 2 Drive Cable | 17 00 | 2.55 | 19.55 |
| 4 Drive Cable | 32.00 | 4.80 | 36.80 |
| Printer Cable | 17 00 | 2 55 | 19.55 |
| Centronics Parallel Interface for unexpanded Genie | 33 00 | 4 95 | 37 95 |

Mail Orders to:
MICRODIGITAL LIMITED
FREEPOST (No stamp required)
Liverpool L2 2AB

Retail Premises at
25 BRUNSWICK STREET
LIVERPOOL L2 0PJ
Tel: 051 227 2535/6/7

Free delivery within the mainland U.K.
12 month guarantee
all equipment tested before despatch
[illegible]

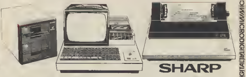
MICRODIGITAL

● **New low price**

# Sharp MZ80K

[illegible] **2 years** [illegible] Apple hardware [illegible]

## The quality single unit computer with 48K RAM £460 + VAT



For ad[illegible] its quality and reliability [illegible] competitively priced.

Notable features of the basic unit are the [illegible] 3 Octave Music Synthesiser and the high speed (1200 bps) cassette interface.

System expansion is via an interface unit (MZ 80 I/O) via which are connected the printer, the dual disk drive, the second dual disk drive and the universal interface card.

The basic unit comes with a 14K BASIC interpreter and the disk drives come with an enhanced disk version of this. Alternatively Xtal BASIC can be used with the computer and the industry standard CP/M disk operating system is available for disk based systems.

Ledgers and stock control software are available free when full systems are purchased.

| Prices | Nett | Vat | Total |
|---|---|---|---|
| MZ 80K Computer 48K RAM | 460.00 | 69.00 | 529.00 |
| MZ 80 I/O Interface Unit | 82.00 | 12.30 | 94.30 |
| MZ 80 FD Dual Disk Drive | 640.00 | 96.00 | 736.00 |
| MZ 80 FDK Dual Add on Drives | 565.00 | 84.75 | 649.75 |
| MZ 80 P3 Printer | 415.00 | 62.25 | 477.25 |
| MZ 80 I/O 1 Universal Interface Card | 40.00 | 6.00 | 46.00 |
| MZ 80 T1 Assembler | 36.00 | 5.40 | 41.40 |
| MZ 80 T20C Machine Language | 18.00 | 2.70 | 20.70 |
| XTAL BASIC | 40.00 | 6.00 | 46.00 |
| CP/M Disk Operating System | 200.00 | 30.00 | 230.00 |

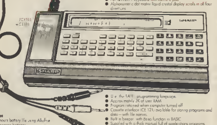
# Sharp Pocket Computer

● **New low price**

## A Genuine advance in technology

**£82 + VAT**

- Full QWERTY keyboard with numeric pad
- Alphanumeric dot matrix liquid crystal display scrolls in all four directions



- Uses the BASIC programming language.
- Approximately 2K of user RAM
- Program retained when computer turned off
- Cassette interface (CE 121) available for storing programs and data — with file names.
- Built in beeper with Beep function in BASIC
- Supplied with a thick manual full of applications programs.

**Features**

- 100 hours battery life using Alkaline manganese batteries
- Compact size 175 x 70 x 15mm and light weight 170g

| Our Low Prices | Nett | Vat | Total |
|---|---|---|---|
| PC1211 Pocket Computer | 82.00 | 12.30 | 94.30 |
| CE121 Cassette Interface | 12.00 | 1.80 | 13.80 |

Mail Orders to
MICRODIGITAL LIMITED
FREEPOST (No stamp required)
Liverpool L2 2AB

Retail Premises at
25 BRUNSWICK STREET
LIVERPOOL L2 0PJ
Tel 051 227 2535/6/7

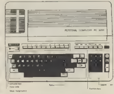
Free delivery within mainland UK
12 month guarantee
all equipment tested before despatch
[illegible] welcome

**Available February, 1981**

# Sharp PC 3200 Desk Top Computer System

[illegible] extended to 2 years [illegible] for 1

## Sets new high standards for big microcomputer systems.



This is the machine all the others will have to beat with a fabulous list of features

**RAM**
64K – (expandable to 96K summer 1981)

**ROM**
32K (expandable up to 72K) including BASIC Interpreter

**Video Monitor**
- Green displays
- 80 chars x 25 lines / 40 chars x 25 lines — Selectable
- Reverse video
- Blinking video
- Selected scrolling – left right up and down
- Pseudo line and matrix drawing function
- Graphic function = 160 x 50 dots

**Keyboard**
- Full ASCII format typewriter style
- Numeric key pad
- Cursor control keys
- 10 User definable keys
- 7 function keys
- Repeat key
- 96 character keyboard buffer

**Clock and Calendar**
Built in Clock and Calendar with rechargeable battery back up

**Printer**
- 80/132column dot matrix logic seeking bi-directional printer
- Double width print
- Upper & Lower case plus graphic characters
- Pin Feed

**Floppy Disks**
- Twin 5¼" disk unit giving total capacity of 568K.
- Double sided – Double density
- Up to 8 drives can be connected giving total capacity of 4.5 megabyte

**Future Enhancements**
- 8 inch Floppy disks – 1 Megabyte capacity available Summer 81)
- RS 232C interface – (available Summer 81
- General Purpose I/O Card – (available Autumn 81

The BASIC supplied with the PC 3200 is one of the best yet available. The following is a list of some of the enhancements over other BASIC interpreters

**Statements**
- Dim – Multi dimensional arrays in excess of two
- Print Using Call – Print formatted as specified in IMAGE Statement
- "Subprogram" – Call SUBPROGRAM with specified parameters
- DFK – Define the definable keys
- Keyin – Enables precise definition of input format for both numeric and string variables
- Move – Creates string variables of any length greater than 255 – Also enables the copying of sections of program
- Search – Search for a variable or any array for a specified – string and the string position is returned into a specified – numeric variable
- Wait – Program execution is halted for a specified interval or – until a specified time
- BL – Sets C.R.T. to blinking in specified area
- RV – Sets C.R.T. to reverse video in specified area
- Line – Draws ruled lines either horizontal or vertical according to specified parameters.
- Scroll – Specified areas of the C.R.T. can be scrolled left right – up or down.
- Table – Forms a lattice on the C.R.T. using ruled lines or a – specified character
- Merge – Merges two BASIC programs
- Aload – Causes the ALOADED Program to be loaded and RUN – at power ON
- Debug – Machine code programming utility

**Commands**
- Auto – Auto line numbering
- Delete X Y – Delete Program lines X Y
- Edit X – Edit program line X
- Erase A(*) – Clear numeric array variable A.
- List print – Print the whole program with page No. date & time – and TITLE being printed on each page
- Ren – Renumber program.
- TR – Trace the execution of the program

**Disk Statements**

Statements allow both random and sequential data files to be handled.

Programs can be stored in either ASCII or binary format
- VSAVE/VLOAD – Stores/Loads the contents of the C.R.T. in a disk – file
- VSAVE*/VLOAD – Stores/Loads the ruled lines, reverse video – and blinking state of C.R.T. in a disk file

The PC 3200 is sold only as a complete system consisting of
- ● computer
- ● video monitor
- ● dual disk drive
- ● all plugs and leads
- ● printer

| Price | Nett | Vat | Total |
|---|---|---|---|
| PC 3200 System | 2995.00 | 449.25 | 3444.25 |

Place your order now to get one of the first machines in the UK

**SHARP**

CRA · LASKYS · VISA

Mail Orders to
MICRODIGITAL LIMITED
FREEPOST (No stamp required)
Liverpool L2 2AB

Retail Premises at
25 BRUNSWICK STREET
LIVERPOOL L2 0PJ
Tel. 051 227 2535 6 7

Free delivery within mainland UK
3 month guarantee on
all equipment [illegible] before despatch
[illegible]

# Printers

**Watanabe 'Digi Plot'**

Now a low cost Plotter easily interfaced to almost any computer. The DigiPlot incorporates all intelligent [illegible] required for producing graphs and drawings. There are many uses for this Plotter ranging from design, research and development to administrational flowcharts and graphs. Control is via a 7 bit ASCII Parallel interface. This can be interfaced to nearly any microcomputer using set subroutines.

| Price | Nett | Vat | Total |
|---|---|---|---|
| Digi Plot | 895.00 | 134.25 | 1029.25 |

**Microline 80**

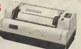
Now an old favorite the MICROLINE has established itself on the market as one of the most reliable and versatile printers available. This quiet 5 x 7 dot matrix printer prints at 80cps and is capable of producing graphical output. It comes complete with 96 character set and centronics compatible interface. You can select from 40 80 and 132 characters per line in software. The 40 character output is double size 80 character is at 10 cp 132 character is at (16.5 cp). Now at a new low price, exceptional value.

| Price | Nett | Vat | Total |
|---|---|---|---|
| MICROLINE 80 | 395.00 | 59.25 | 454.25 |
| Ribbons (available in blue black green red and brown) | | | |
| | 2.25 | 0.34 | 2.59 |

**Paper Tiger (Models 460 and 560)**

These are the latest models from the TIGER family. The 460 has higher speed (120 cps) and prints bi directionally. There is a 96 character set which can be printed at 80 96 or 132 characters per line. The 9 x 9 dot matrix head has a life of 300 million characters and gives a very good print quality. RS232 and parallel interfaces are available. The 560 option is slightly quicker (120-160 cps) and is a full 132 column machine. It can accomodate 15 inch paper and has two print and speed modes. Naturally both these printers have full graphical capability.

| Price | Nett | Vat | Total |
|---|---|---|---|
| Model 460 | 795.00 | 119.25 | 914.25 |
| Model 560 | 995.00 | 149.25 | 1144.25 |
| Paper (2000 sheets) | 31.00 | 4.65 | 35.65 |



**Seikosha GP-80**

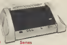
At last an economic [illegible] the lowest cost smallest impact graphic [illegible] world. Graphics normal (12 cpi) and double width [illegible] characters can be printed on the same line. Pinfeed tractor [illegible] a standard. The printer prints on plain paper and uses a continuous self inking ribbon. There is a wide range of optional interface boards available. A truly remarkable dot matrix printer it prints at 30 cps using a 5 x 7 dot matrix. A parallel interface is standard.

| Price | Nett | Vat | Total |
|---|---|---|---|
| GP 80 | 250.00 | 37.50 | 287.50 |
| Interfaces. | | | |
| RS232c | 50.00 | 7.50 | 57.50 |
| IEEE 488 or APPLE II | 30.00 | 4.50 | 34.50 |
| PET | 32.00 | 4.80 | 36.80 |
| CABLES | 25.00 | 3.75 | 28.75 |

**Mannesmann Tally M80 MC**

The two keywords of this printer are reliability and long life. This is a true commercial printer which is ideal for long report generating or constant use. This 80 column device prints bidirectionally at 200 cps and utilises a [illegible] x 7 dot matrix as standard. It comes complete with a parallel interface and a 96 character set. You can select from 10 characters per inch and 16.5 characters per inch each mode has a double width option enabling you to highlight headlines etc.

| Price | Nett | Vat | Total |
|---|---|---|---|
| M80 MC | 1000.00 | 150.00 | 1150.00 |



**Anadex DP 9500 Series**

The DP 9500 is designed for all printer applications. It comes complete with three ASCII compatible interfaces a RS232c, an input that accepts 20/60 ma current drive mode and a centronics input. This is a truly amazing printer with a myriad of features. These features include a high density graphics mode (suitable for APPLE graphics printing) a 600 character buffer 150 200 cps programmable horizontal and vertical tabs self test 96 characterset normal, condensed and expanded print the list seems endless. If you need a high speed versatile printer look no further.

| Price | Nett | Vat | Total |
|---|---|---|---|
| DP 9500 | 895.00 | 134.25 | 1029.25 |
| DP 9501 | 995.00 | 149.25 | 1144.25 |
| New for 81 | | | |
| Microline 82 | 550.00 | 82.50 | 632.50 |
| Centronics 737 | 425.00 | 63.75 | 488.75 |

Mail Orders to
MICRODIGITAL LIMITED
FREEPOST (No stamp required)
Liverpool L2 2AB

Retail Premises at
25 BRUNSWICK STREET
LIVERPOOL L2 0PJ
Tel 051 227 2525/6 7

Free delivery within mainland UK
12 month guarantee
all equipment tested before dispatch
[illegible] welcome

# Apple II

**Unmatched flexibility and versitility from the world's best selling computer.**

[illegible] 2 years

Sales and Service

Microdigital supply a 48k machine for the price of a 16k machine we supply a Black and White modulator free and give free delivery and twelve month guarantee

| Price | Nett | Vat | Total |
|---|---|---|---|
| Apple II Computer 48k | 695.00 | 104.25 | 799.25 |

All Apples supplied by us are legitimately imported and are genuine 230V Europlus models.

## Disk Subsystem

The latest DOS 3.3 16 sector disk drive with controller which replaces the old model

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 383.00 | 57.45 | 440.45 |

Second disk drive uses same controller as first drive.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 299.00 | 44.85 | 343.85 |

## Language System

This package includes the Language Card, which allows APPLE users to take immediate advantage of the powerful PASCAL language as well as the Integer and Applesoft BASIC interpreters. The Lanuage Card's 16K bytes of RAM memory electrically replace the ROM firmware built into each APPLE. Upon start up this RAM memory is automatically loaded from disk with the user's choice of languages then electrically protected from change.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 299.00 | 44.85 | 343.85 |

## Apple Fortran

Apple FORTRAN is ANSI Standard Subset FORTRAN 77. These latest computer industry standards provide significant additions and enhancements over previous 66 standards (FORTRAN IV). An example of this is the expanded IF statements that have been added to traditional FORTRAN statements.

Apple FORTRAN operates in the Apple Pascal Language system offering the same comprehensive software development environment provided to our Pascal programmers. The Editor Linker, Filer and Assembler can all be used with the Apple FORTRAN compiler which like Pascal, produces P code.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 120.00 | 18.00 | 138.00 |

## MICROSOFT Z-80 Softcard

The Z 80 SoftCard is a plug in peripheral card for the Apple II that actually contains a Z 80 microprocessor and allows the Apple to run software written for Z 80 based computers. Also included on diskette in the SoftCard package are the CP/M operating system and Microsoft BASIC the two most significant microcomputer software packages ever developed. All of the features of the Z 80 SoftCard package add up to an incredible value for Apple II owners

### Thousands of Applications

Literally thousands of CP/M based applications can be easily converted to run with the SoftCard simply by transferring CP/M files from your CP/M source machine to the Apple via a comm line. A utility is included with the SoftCard to facilitate this transfer

### Apple Compatibility

The SoftCard runs with almost every Apple product from the Apple II to Apple II Plus, Language Card and peripherals. Independent peripherals are supported too. A SoftCard software utility lets you transfer Apple DOS files onto a CP/M disk

### Easy Installation

The SoftCard plugs in to any of the Apple's peripheral slots. No hardware modification is required

### Requirements

Apple II or Apple II Plus
48K Memory*
1 Disk Drive
*When used in a 48K machine 44K of memory is available. When used with a Language Card 56K is available.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 170.00 | 25.50 | 195.50 |

Mail Orders to
MICRODIGITAL LIMITED
FREEPOST (No stamp required)
Liverpool L2 2AB

Retail Premises at
25 BRUNSWICK STREET
LIVERPOOL L2 0PJ
Tel 051 227 2525/6/7

Free delivery within [illegible]
12 month guarantee
[illegible] equipment tested before despatch
[illegible] orders welcome

# Apple II

Validity of Guarantee now extended to **2 years** on all Sharp and Apple hardware purchased after [illegible]

## Unmatched flexibility and versitility from the world's best selling computer.

### Cobol

CIS COBOL is a complete software system for compiling, testing, debugging, and executing standard COBOL programs.

It is called CIS COBOL because it s Compact Interactive and Standard.

**Compact**

Standard CIS COBOL runs on systems of 48K bytes and up.

**Interactive**

CIS COBOL has features specifically tailored to interactive applications – in which the operator communicates directly with the program via a CRT screen and keyboard It also caters fully for interactive program development

**Standard**

CIS COBOL conforms to the ANSI 1974 standard for COBOL, so that programs can be transferred to your system from other computers, or vice versa.

The two principal components of CIS COBOL are the CIS COBOL compiler and the CIS COBOL Run Time System

Requires Z-80 SoftCard in a 48K system

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 425.00 | 63.75 | 488.75 |

### Forms – 2

Screen formatter/ Program generato

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 100.00 | 15.00 | 115.00 |

### Carrying Case

The Apple is truly portable and this padded vinyl, leather look case protects your Apple in transit and makes it easier to carry

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 16.00 | 2.40 | 18.40 |
| Dustcover | 9.95 | 1.49 | 11.44 |

### Appletel

The Appletel package provides the means to bring the Apple II computer and the Prestel service together

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 595.00 | 89.25 | 684.25 |

### Graphics Tablet

The Graphics Tablet is an image input device that allows the user to enter pictorial information directly (by sketching or tracing) from:

- —maps and photographs
- —logic diagrams and schematics
- —histograms
- —architectural drawings
- —fine art

Tracing a shape on the tablet surface converts the image to digital values. This information is displayed on the video monitor and may be stored on disk for later processing by the Apple

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 462.00 | 69.30 | 531.30 |

### DOS 3.3

Apple s new DOS, DOS 3.3 contains two significant improvements for the Apple owner. It creates a compatible environment so that the Apple owner can easily and efficiently use his Applesoft Integer and Pascal programes on one set of hardware. The second benefit for the user is that the disk space available is increased 23%. Under the old operating system approximately 103,000 bytes where available to user. With the new DOS 126,974 bytes will be available for user programs

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 39.00 | 5.85 | 44.85 |

### Silentype Printer

The Silentype allows printing of high resolution graphics at 60 dots per inch at 40 upper/lower case characters per second and 80 characters per line. The Silentype eliminates the loading or writing of a programme to print a screen configuration, because you can dump any high resolution screen directly to the printer

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 349.00 | 52.35 | 401.35 |
| 10 rolls thermal paper for Silentype | 28.00 | 4.20 | 32.20 |
| Dustcover for Silentype | 9.95 | 1.49 | 11.44 |

### Double Vision 80 Column Card

The adapter displays upper and lower case characters and is highly compatible with BASICS and PASCAL. In BASICS PR# O does not switch off the card, a distinct advantage over some others. A 12" monitor is essential when displaying 80 Columns.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 162.00 | 24.30 | 186.30 |
| Software to convert to Pascal | 12.00 | 1.80 | 13.80 |

### Alf Music Synthesiser

**Three simultaneous voices**
**Interactive graphics music entry**
**Complete, ready to use**
**Stereo outputs**
**Pitch, envelope, and volume**
**Expandable to 6 or 9 voices.**
**No "music languages" to learn**
**Full piano range**
**No tuning required**
**Save and load songs**

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 95.00 | 14.25 | 109.25 |
| Timing Mode Input Board | 14.00 | 2.10 | 16.10 |
| Alf Music Album O (Xmas) | 12.00 | 1.80 | 13.80 |
| Alf Music Album 1 | 12.00 | 1.80 | 13.80 |
| Alf Music Album 2 | 12.00 | 1.80 | 13.80 |

## Apple Cards

### Parallel Printer Interface

The Parallel Printer Interface Cards are available to allow the use of parallel printers with your APPLE computer

| Price | Nett | Vat | Total |
|---|---|---|---|
| Parallel | 104.00 | 15.60 | 119.60 |
| Centronics | 130.00 | 19.50 | 149.50 |

### Communications Interface Card

The Communications Interface Card is available separately to allow you to connect your APPLE to modems, CRT terminals, and other devices employing a serial RS 232C interface. The card's built in intelligence lets you control these devices easily in BASIC.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 130.00 | 19.50 | 149.50 |

### Eurocolour Card

Produces PAL colour signals to drive colour video monitor or with a Black & White modulator drives a colour T.V.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 113.00 | 16.95 | 129.95 |

### Hobby/Protyping Card

Create your own APPLE interface boards with the wire-wrap card. The 2¾" x 7" double sided circuit board includes a hole pattern (on 100 mil centres) that accepts all conventional IC s and passive components. It plugs directly into any APPLE expansion

(Continued overleaf)

Mail Orders to:
MICRODIGITAL LIMITED
FREEPOST (No stamp required)
Liverpool L2 2AB

Retail Premises at
25 BRUNSWICK STREET
LIVERPOOL L2 0PJ
Tel 051 227 2535/6/7

Free delivery within mainland U.K.
12 month guarantee
all equipment tested before despatch
bonafide official orders welcome

# Apple II

[illegible] 2 years [illegible]

## Unmatched flexibility and versitility from the world's best selling computer.

connector and fits entirely within the computer case. Supplied with complete bus documention to aid the interface designer.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 15.00 | 2.25 | 17.25 |

### Serial Interface

The Serial Interface Card allows an APPLE computer to exchange data with computers, printers and other devices in serial format (one bit at a time). It is intended for use (in place of the Communications Interface Card) in applications that:

—Use data rates other than 110 or 300 baud (10 or 30 char/sec)

—Involve serial printers that don't require handshake

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 113.00 | 16.95 | 129.95 |

## Heuristics

**Heuristics**

### Speechlink Model H2000

A practical low cost speech recognition peripheral for the Apple® computer that allows you actually to talk to your Apple

- To enter data.
- In control programs and the disk.
- to control other equipment attached to the Apple

The H2000 substitutes your voice for the keyboard. It enables you to think and control your computer at the same time concentrating on the action — the video display, printer output, or external action under computer control.

### Features

- Recognise 64 words or phrases of your choice on the Apple® computer
- Link more than one set of 64 words to provide essentially unlimited vocabulary
- Write your programs in BASIC (no assembly language coding required)
- Use it with Applesoft® Floating Point BASIC or Integer BASIC Extendable to Pascal)
- Requires only 4K RAM to recognize 64 words or phrases
- Run under Disk Operating System or Cassette Tape System.
- Small pre trained vocabulary facilitates system use
- Complete with microphone, manual, demonstration software, and one year warranty

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 168.00 | 25.20 | 193.20 |

### Model 70 controller

Provides four relay contact closure outputs on a card which plugs into an Apple® II peripheral slot and which is completely controlled by POKE statements in Apple® II BASIC. The unit is recommended for use with Heuristics™ SpeechLab® and SpeechLink™ voice data and control input cards for the Apple® II but may be used with any Apple® in any application. More than one Model 70 may be used in an Apple®

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 57.00 | 8.55 | 65.55 |

### Speechlab Voice Recognition Card

Allows the Apple to recognise a spoken vocabulary of up to 32 user selected words. The computer can be programmed to perform any task desired upon recognition of a key word.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 122.00 | 18.30 | 140.30 |

## Mountain

**Mountain Hardware, Inc**

### Clock/Calendar Card

This plug in card provides a 388 day calendar and clock, with resolution to 1/1000 second. The clock is crystal controlled to yield .001% accuracy. A built in rechargeable battery keeps the clock on time up to four days without system power, and external batteries may be used for longer periods. Optional interrupt capability simplifies control applications. Supplied with complete operating instructions and rechargeable battery.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 168.00 | 25.20 | 193.20 |

### ROM Plus card

ROMPLUS + provides six sockets to accept individually addressable 2K ROMs or EPROMs. Keyboard Filter a 2K ROM program comes installed on the ROMPLUS + board and adds many useful features to your Apple including

- Upper and lower case letters. The only system that offers keyboard input and standard shift key operation
- Multiple user defined character sets
- Coloured or inverse-coloured letters
- Keyboard macros — two key stroke automatic typing of multiple user defined words or phrases including BASIC and DOS commands.
- Mixed text and graphics.
- Improved cursor control
- STOP LIST and END LIST

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 105.00 | 15.75 | 120.75 |

## Copyplus ROM

For use with ROM Plus Card.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 30.00 | 4.50 | 34.50 |

## Supertalker

### Give voice to your Apple

SuperTalker allows you to add the dimension of human speech output in your computer programs. Add voice to games. Program verbal prompting for the operator of your business system. Use verbal warnings under program control as an enunciator in commercial security or control rooms. Create educational programs that verbally coach the student.

### The SuperTalker system

SuperTalker is a new peripheral system which allows the Apple II computer to output exceptionally high quality human speech through a loud speaker under program control. Output may also be directed through any P.A. or stereo system. Initially spoken words are digitized into RAM memory through the system microphone. Speech data in RAM may then be manipulated like any other stored data.

### A complete package

The SuperTalker peripheral system consists of: The SuperTalker peripheral card which plugs into a peripheral slot on the Apple II, a microphone, a loudspeaker, easy to use operating software and documentation, plus two ready to run SuperTalker programs.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 179.55 | 26.93 | 206.48 |

## Romwriter

### Hardware:

- Programs 2716 EPROMs—5V 2K.
- Installs in any peripheral slot (except # 0).
- Zero insertion force socket. (ZIF) Mechanical lever opens up pin holders to drop in an EPROM
- On board Flat Handle switch for power off to ZIF Socket permits EPROM to be Installed/Removed without power down of computer
- On board DIP switch provides
  Write Protect—provided to prevent accidental overwriting of EPROMs while RUNing for RomWriter. $CFFF Off provided to suppress execution of this command (which shuts off all peripherals in the Apple system when executed) while programming or later while RUNning

Mail Orders to:
MICRODIGITAL LIMITED
FREEPOST (No stamp required)
Liverpool L2 2AB

Retail Premises at
25 BRUNSWICK STREET
LIVERPOOL L2 0PJ
Tel 051 227 2535/6/7

Free delivery within mainland UK
12 month guarantee
all equipment tested before despatch
bonafide official orders welcome

made by other interested parties, on what is essentially a scarce resource, are considerable. Because of the time lag between the first and last groups using a simulation, pre- and post-simulation work must be very well organised: tasks, materials, assessment procedures.

A decision to use the packages clearly has implications beyond their immediate use. On one occasion, however, by way of experiment, a whole class of students was taken to Norwich City College to run DRAKE from the terminal room with its very adequate multi-terminal access, so bypassing this problem.

Although it is possible and reasonable for the teacher to take part in the simulation as a member of the group, the usual practice is for teacher and group to engage in a post-simulation discussion. This is undertaken for a number of reasons.

In the first place, it serves to reinforce what has been learnt; the output contains a considerable amount of historical detail about the topic in question. It is also sometimes necessary to clarify points, and always the simulation throws up questions to be answered and issues to be considered. Now the discussion can take off in any direction dictated by the interests of the children.

The next stage is to lead them on to an examination of the problems faced by the historical characters in question, using as evidence information which has been gleaned from the run. The result forms the basis for an original piece of written work, and it is hoped that the students will develop an appreciation of what it was like.

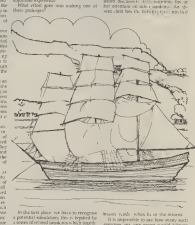
In the case of CAMPAIGN, the discussion is taken a stage further. We are interested in Edward's qualities of leadership, and these too are considered in the light of evidence from the run. One of the recurring concepts of the second year history course is leadership; the simulation complements this aspect of the work.

It is hoped that students, as well as learning about a particular historical situation or series of events (in the sense of "what happened") in some depth, will, more than could reasonably be achieved from their own reading and in some considerable detail (many people would regard the detail of history as that which makes it fascinating), develop a sense that historical events are (often) a function of decisions taken. This holds true even though soon after reaching Crecy they are plunged into a study of the Black Death – which it can hardly be argued was a function of significant decision making.

As well as having the explicit learning objectives, the simulations are intended to create *active* roles for the students in the classroom, something which I value and consider particularly important. Also, the simulation is generally acknowledged as being a good motivator, combining, as it does, doing with a concrete experience. The students' reaction is habitually one of interest, concentration and enthusiasm, depressed, it seems, only because there are no similar exercises for them to do.

Working in small groups, with relaxed teacher supervision, ensures that all students have a chance to express their opinions and argue their case, freed from the inhibitions attending class discussion and teacher control. It is interesting to note that when engaged in post-simulation discussion, few students appear to consider that they are working, but rather that they are simply talking over a recent enjoyable experience.

What effort goes into making one of these packages?



In the first place, we have to recognise a potential simulation; this is typified by a series of related incidents which together form a whole. The topic must then be researched in a general sense.

Next, decision points must be established; the more one researches, the more there appear to be. Then we must attempt to resolve the contradictions which inevitably arise between texts consulted and to bring into focus the grey areas which have emerged.

These preparatory stages are followed by a draft program. This is then conveyed to a coding sheet as a tidied version before being keyed in, no small task in itself since this type of program is necessarily expensive in terms of text.

Cosmetic changes are made to the program and then it is tested and de-bugged. A booklet has to be designed and trial copies produced.

The program is then used by students and the program and documentation revised in the light of their experiences with them. More checking for errors. Booklets printed. Implementation.

How long does all this take? Hours (and hours). But once it is done there is a lesson which can sit on a shelf, more accurately reside on a disc, until it is required. The computer will effectively manage the learning situation as it guides the students' progress during a run, leaving the teacher free until the post-simulation discussion to concentrate his or her attention on other students. An absent child has the benefit of a controlled lesson ready when he or she returns.

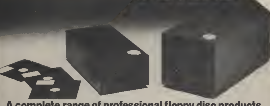
It is impossible to say how many such exercises any one group would tolerate (one young man generously suggested 50) but, given adequate hardware and access to it, a library of programs would appear to have some merit. However, until the pupils in a class can expect to run a program simultaneously, it seems unlikely that we will be able to offer more than one in any given year. Some software is here; it's the hardware. ■

---

*Anthony Payne BA Cert Ed is currently Education Advisor to the British Library Research and Development Department project "Computerised Information retrieval in secondary schools". His book *Computer Software for Schools* is to be published by Pitman.

NEW FROM

# HAL COMPUTERS



# A complete range of professional floppy disc products from the industry leaders....compatible with TRS 80, Superbrain, Ohio, SWTP, North Star Horizon, Zenith, Cromemco etc.

You can now buy the entire range of Tandon Magnetics high quality, market leading mini flexible disc drives direct from the exclusive U K. Distributor

Tandon drives are available as either the OEM product or as complete packaged units in single or dual drive British manufactured cabinets with high reliability power supply Complete pre-test and burn in ensures reliability and all drives carry a full 6 months parts and labour warranty

## MADE IN UK BOXED DRIVE PRICES

| | Single Box | Dual Box |
|---|---|---|
| Single Sided 40 track | £250 00 | £430 00 |
| Double Sided 40 track | £330 00 | £599 00 |
| Double Sided 80 track | £430 00 | £808.00 |
| Dual Boxed Single Sided plus double sided | £549 00 | |

With Tandon you get 40 or 80 tracks–more capacity and step rates as low as 3 mS track to track–up to ten times the speed of other drives.

## NEW MICROTEK PRINTERS

So reliable we give you 365 days warranty
40 80 120 132 columns.
125 cps. 70 lines/minute
96 characters, upper/lower case.
Prices start at £460 00
Interface cables for Apple, TRS 80 etc.

## NEW STROBE PLOTTERS

The Strobe drum plotter uses low cost colour pens to draw graphs, charts and pictures with 004 resolution

Prices start at £545 00
Interfaces and software for TRS-80 Apple, PET Horizon, S-100 on 5 and 8 diskettes.

## STORAGE SYSTEMS

Use our discoflex range of storage wallets and boxes to protect your discs when not in use or for sending through the post.

5¼ ____ £10 00
8 ____ £12 00

## POWER SUPPLIES

Our range of Power–One power supplies covers single, dual and triple output not to mention a complete selection of supplies which power all popular floppy disc drives.

## MADE IN UK SERVICE AND MAINTENANCE

For the large scale user of 5¼" or 8" floppy disc drives, our range of alignment diskettes and service tools are a must. Send for details of our Oasis range of portable dedicated and non dedicated floppy disc and peripheral test and exerciser systems.

For immediate information on any of these products please contact:

**HAL COMPUTERS LIMITED**
133 Woodham Lane New Haw
Weybridge Surrey KT15 3NJ
Tel Weybridge (0932) 48346/7
Telex. 8813487

# EASY ADMISSION

*The computer at the Universities Central Council on Admissions*

**M**ost people have known the trials of school tests or assessment procedures or exams — so can sympathise with school leavers who want to go on to university. This in itself is often a tiresome ordeal—the student must find out at which universities vacancies exist and whether his or her qualifications are suitable

Britain's prospective undergraduates however are at least spared one headache that many of their colleagues overseas suffer They don't have to write endless letters before finding a college that will accept them or wade through masses of literature from individual universities A computer at the Cheltenham based Universities Central Council on Admissions (UCCA) takes care of all that

UCCA was established by the universities in 1961 to co-ordinate admissions through one uniform procedure School leavers – whether from the Highlands Cornwall or the East End of London – simply write or phone UCCA one year before they want to go to university to apply for one of UCCA's application forms

The student is sent an application form together with a booklet giving details of all college courses available in this country's eighty two universities (this includes forty two London colleges) This form has to be filled in and returned to UCCA so that the information on it can be stored by UCCA's Sperry Univac 90/60 computer and so that applications can then be automatically made on behalf of individual students to the universities of their choice Students are allowed to apply for a maximum of five universities or courses All the applicant then has to do is wait for the replies from the relevant universities and decide by May which two (giving a definite first choice) he prefers

Now he is free to concentrate on his most pressing problem – passing A levels at the relevant grades!

Meanwhile back at UCCA, the computer continually logs updates and transfers information by means of batch and online working Because there are currently about 160,000 young men and women who apply to go to college, and each of these have five options there is a lot of information that has to be stored and manipulated electronically

Head of Data Processing, Ken Horsburgh says It has taken us eighteen years to get where we are today and we are proud of the service we can now offer – I can't remember that we have ever made any mistakes UCCA type systems in other countries are very much in their infancy

At school time flies in the last sixth form months Exams come and go – and the ultimate truths of passes and fails are revealed

About a third of all applicants get the A levels they want and start to pack their bags and think about academic careers (A lucky few in terms of total applicants some 16 000, will have probably already packed their bags having been unconditionally accepted by a university in the first round)

### Last chance

Another 25 000 or so however will still have a big problem These are the ones who did not get the A levels required for the courses they wanted or perhaps applied too late to go through the original sifting and are still determined to go to university There are also some students who did better than expected and want to raise their sights These are the school leavers for whom UCCA performs a last valuable service It offers a clearing facility – which means that many of UCCA's 120 staff have a very busy September

What happens is this A student who has the basic minimum two A' level passes can be accepted for clearing In this process he is given a second chance of getting to university Again all he has to do is to complete a simple form

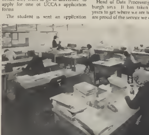
Eventually, information filters in from the universities about places still available and information comes in from students about the courses they want A giant matching operation then begins

This is one procedure that is done clerically UCCA will refer a student to where his best option appears to be If he rejects this the staff at Cheltenham will investigate further options for a second third and (total work load permitting) fourth time

Computerisation at this stage is only to the extent of controlling where a card is doing It is obviously important for UCCA to know at any given time precisely what is being offered to whom and who has accepted what'

### Continuing application procedure

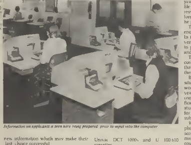
UCCA has also recently set up a new system called CAP (Continuing Applica-



*The main office of UCCA is where it all starts applications from the 160 000 students who annually apply to go to University via the UCCA system are received and opened here Further details on applicants whose records are already stored in the computer are accessed via the Terminal seen in the corner* tion Procedure. It is designed to help the thousands of students (30 000 last year) who did not get an offer in the first round of applications.

Headmasters and mistresses had been getting concerned that those students who had not had positive responses from colleges might miss out on motivation – and perhaps do worse in their examinations because of it.

CAP therefore allows these candidates one additional choice of course – with the advantage of an important bit of



*Information on applicants is seen here being prepared prior to input into the computer*

new information which may make their last choice successful.

UCCA sends each candidate some statistical information (prepared from the computer files) about the popularity of different courses. In cases therefore where the student has originally applied for courses that are highly competitive his last CAP choice may be more realistic.

When you appreciate the popularity of some courses – medical schools, for instance, offer 34 places after sifting 2,000 applications – a realistic appraisal can very easily mean the difference between success and failure'.

In 1979, the first time CAP operated, 2 500 students got an offer at this stage.

### UCCA's computer system

The computer system which powers all this activity consists of the Sperry Univac 90/60 central processor which has half a megabyte of storage, five 8430 drives, five tape drives, a card reader and card punch, two line printers and three in-house terminals for file updating and enquiries. The 90/60 installed in 1978 replaced a Sperry Univac 9480 and thus entailed a change of operating systems from OS4 to VS9. (The 9480 itself was installed in 1973, while prior to that UCCA had used a Univac solid state computer in 1962, shortly after its establishment, a Univac 1050 in 1966 and a Univac 9400 in 1970.)

Although most of the operating is batch processing, with student application forms being microfilmed on to punched fiche cards, a total of thirteen universities are now actually on-line to Cheltenham. These are Lancaster, Leeds, Sheffield, Warwick, Kent, Keele, Essex, Cardiff, Bradford, York, Sussex, Chelsea and City. Terminals used are Sperry Univac DCT 1000s and U 100 610 cassettes.

For these colleges applications procedures are considerably speeded up. Information that under the batch system would have to go by post can go directly down the line – and enquiries can be made by the colleges at any time during the working week.

Ken Horsburgh looks forward to an expansion of the communications network. 'I hope that one day all universities will be on line to the UCCA's computer which would give them a better and quicker service and us more time to develop other statistical systems that could be of use to the education authorities.'

### Academic records file

Already UCCA deals with one important application unconnected with their main applications function. A few years ago they set up an academic records file on behalf of all universities. The progress of every UK undergraduate is therefore now recorded on disc and tape as he passes each course assessment.

There is no doubt UCCA has derived enormous benefits from computerisation. In fact, it could not work without it. A veritable army of clerks would be needed to provide the same service to students and universities.

The main advantages are two-fold, according to Mr Horsburgh. The first is that universities can make best use of their resources.

Before UCCA there was often a chaotic situation at some colleges in the first few weeks before the start of the academic year. Some students had backed out of commitments. Courses set up had insufficient people to go on them – and other students were badgering the authorities for places on courses already over-subscribed.

With the extended pre-planning applications procedure, and with readily accessible information on expected demand, universities can better plan courses.

Second is the undoubted advantage for school leavers. They now have the best information on which to make choices – and most of the hard administrative work to do with applications is taken out of the already tough task of getting to university. ■

*UCCA's Sperry Univac 90/60 computer system continually logs and updates its information by means of batch and on line working*

# NEW! Produced in U.K. and widely used in England and USA
# COMPLETE BUSINESS PACKAGE

INCLUDES EVERYTHING FROM INVENTORY & DATABASE MANAGEMENT
TO SALES SUMMARY. PROMPTS USER. VALIDATES ENTRIES. MENU DRIVEN
PET and CP/M SUPERBRAIN, TRS80 N STAR, MS5000
[illegible]
[illegible]

* PROGRAMS ARE INTEGRATED
1 ENTER NAMES & ADDRESSES
2 ENTER PRINT INVOICES
3 ENTER A/C RECEIVABLES
4 ENTER PURCHASES
5 ENTER A/C PAYABLES
6 ENTER UPDATE INVENTORY
7 ENTER UPDATE ORDERS
8 ENTER UPDATE BANKS
9 REPORT SALES LEDGER
REPORT PURCHASE LEDGER
INCOMPLETE RECORDS
USER DBMS AREA

* SELECT FUNCTION BY NUMBER
13 *PRINT CUSTOMERS STATEMENTS
14 *PRINT SUPPLIER STATEMENTS
15 *PRINT AGENT STATEMENTS
16 PRINT TAX STATEMENTS
17 LETTER TEXT AREA
18 ALTER VOCABULARIES
19 PRINT YEAR AUDIT
20 PRINT PROFIT LOSS A/C
21 OPEN AREA
22 PRINT CASHFLOW FORECAST
23 ENTER PAYROLL NO RELEASE
24 DISK SWAP EXIT

ENTER WHICH ONE?

DATABASE MANAGEMENT INCLUDES
SELECT CREATE DELETE AMEND SEARCH PRINT 4 WAYS
INFORMATION RETRIEVAL ON ANY KEY RECORD OR PART THEREOF
AUTOMATIC CHECK TO PREVENT DOUBLE ENTRY TO FILE SYSTEM
DYNAMIC ALLOCATION OF INFORMATION CONSERVING DISK SPACE

VERY FLEXIBLE, EASY TO USE

B W COMPUTERS U K ARE THE PRODUCERS OF THIS BEAUTIFUL PACKAGE
*AUTHOR* TONY WINTER [illegible]

PET VER 3.00 LOW LEVEL INTEGRATION 475.00
PET VER 4.00 INCLUDES AUTO STOCK UPDATE 575.00
PET VER 6.00 INCLUDES AUTO BANK UPDATE 675.00
CPM VER 6.00 IN CORE TRANSLATEABLE PLUS DBMS 675.00
CPM VER 7.00 AUTO STOCK UPDATE 875.00
CPM VER 8.00 AUTO BANK UPDATE 975.00
CPM VER 9.00 INCLUDES OPTION [illegible] LATER RELEASE
[illegible]

Super B a n [illegible] performance [illegible] to pay. Standard SuperBrain features include two double density [illegible] 360K bytes of disk storage, 32K of RAM memory (expandable to 64K) [illegible] most sophisticated programming a CP/M* Disk Operating System [illegible] editor, assembler, debugger and [illegible] And with the [illegible] programming power [illegible] S-100 compatible [illegible]
SuperBrain's CP/M operating system boasts an overwhelming [illegible] software of BASIC, FORTRAN, COBOL and APL. Whatever [illegible] Ledger, Accounts Receivable, Payroll, Inventory or Word Processing [illegible] And the SuperBrain QD boasts the same powerful [illegible] double sided drive system [illegible] more than 700K bytes [illegible] full 64K of RAM [illegible]
Whatever [illegible] you'll appreciate the careful attention given to every engineering detail. A full ASCII keyboard with numeric pad and user programmable function keys. A [illegible] specially focused 12 inch CRT [illegible] sharp image everywhere on the screen. Two Z-80 [illegible] processors [illegible] RS 232 communication [illegible]

WE EXPORT TO ALL COUNTRIES CALLING ONLY BY APPOINTMENT CONTACT TONY WINTER ON 01-636 8210
88 BEDFORD COURT MANSIONS, BEDFORD AVENUE, LONDON WC1

NOTE!! Level 9.00 totally in Core Program leaves Master Drive Free (saving of 200 pounds hardware)

---

## IMPORTANT!!! NO COMPUTER HARDWARE IS EVER OF VALUE WITHOUT SOFTWARE, SO WE PROVIDE YOU WITH A STARTING SET OF PROGRAMS **** FREE **** AT 10% OF HARDWARE PURCHASED. A SUPERBRAIN AND NEC SPINWRITER COULD GIVE YOU UP TO 400 POUNDS OF PROGRAMS SEE (                )

| PET • PET • PET • PET • PET • PET | | SOFTWARE • SOFTWARE • SOFTWARE | | SUPERBRAIN • SUPERBRAIN • SUPERBRAIN | |
|---|---|---|---|---|---|
| CBM 3032 32K | £585.00 | BUS VER 3.00 PET | £475.00 | SUPERBRAIN 320K | £1695 [illegible] |
| CBM 3040 DISKS | £585.00 | BUS VER 4.00 PET | £575.00 | TWIN Z80 32K CRT | |
| CBM 3022 PRINTER | £425.00 | BUS VER 5.00 PET | £675.00 | D D S S DRIVE | |
| CBM 8032 32K | £875.00 | BUS VER 6.00 CP/M | £775.00 | SUPERBRAIN 320K | £179[illegible] |
| CBM 8050 1MEG DISKS | £875.00 | BUS VER 7.00 CP/M | £875.00 | TWIN Z80 64K CRT | |
| CBM EPSON PRINTER | £395.00 | BUS VER 8.00 CP/M | £975.00 | 2 D D D S DRIVE | |
| CBM MULTI USER | £650.00 | BUS VER 9.00 CP/M | £1075.00 | SUPERBRAIN 1500K | £2795 [illegible] |
| CBM 3032 + EPSON + | | CBM WORDPRO II | £75.00 | TWIN Z80 64K + CRT | |
| CBM 3040 + BUS V3 | £2215.00 | CBM WORDPRO III | £150.00 | +2 D D D S DRIVE | |
| | | CBM WORD STAR | £195.00 | COMPUSTAR 10 | £15[illegible] |
| PRINTERS • PRINTERS • PRINTERS | | CPM MBASIC 80 | £150.00 | COMPUSTAR 15 | £149[illegible] |
| DIABLO 630 40CPS | £1695.00 | CPM COBOL 80 | £320.00 | COMPUSTAR 20 | [illegible] |
| DOLPHIN BD80 125CPS | £495.00 | CPM PASCAL MT | £150.00 | COMPUSTAR 30 | £249[illegible] |
| NEC 5510 PRINTER | £1895.00 | CPM FORTRAN 80 | £200.00 | COMPUSTAR 40 | £27[illegible] |
| MICROLINE 80 120CPS | £475.00 | CPM DATASTAR | £175.00 | INTERTUBE III | £499[illegible] |
| TELETYPE 43SR 30CPS | £875.00 | CPM PASCAL M | £250.00 | EMULATOR | [illegible] |
| DEC LA34 TRACT 30CP | £875.00 | CPM SYSTAM S BRAIN | £75.00 | 10 MEG H DISK | £295[illegible] |
| NEC 5530 PRINTER | £1585.00 | CPM SUPERSORT | £120.00 | 15 MEG (8 8) | £3950 [illegible] |
| OUME DAISY SPRINT 5 | £1850.00 | CPM BASIC COMPILER | £180.00 | 58 MEG (4DISK) | £7950 [illegible] |
| TEXAS 810 150CPS | £1330.00 | CPM DESPOOL | £30.00 | | |
| | | CPM SYSTAM IMS N STAR | £75.00 | (ADDRESS MAILER) | £95.00 |
| SPECIALS • SPECIALS • SPECIALS | | CPM TEXTWRITER | £75.00 | (STOCK CONTROL) | £95.0[illegible] |
| N STAR QUAD 7 MEG | £1500.00 | CPM POSTMASTER | £75.00 | (DBMS DATABASE) | £15[illegible] |
| MS 5000 48K D D | £1200.00 | CPM SELECTOR 3 | £180.00 | IEEE TO PARALLEL | [illegible] |
| COMPUTHINK "800K" | £795.00 | CPM CBASIC | £75.00 | IEEE RS232 BI DI | [illegible] |
| [illegible] WAY CORDLESS PHONE | £135.00 | CPM MACRO 80 | £75.00 | IEEE TO RS232 | £75[illegible] |
| TELEPHONE ANSWER | £230.00 | CPM W STAR M MERGE | £[illegible]5.00 | S HAND SWTP TERM | [illegible] |
| [illegible] | £135.00 | BUS MANUAL | £9.00 | WARRANTY 6 MONTH FULL REPAIR | |

****** SPECIAL INSTITUTION AND UNIVERSITY DISCOUNTS ******
MOST ITEMS IN STOCK (ACCESS 'AMEXCO' BARCLAYCARD OTHERWISE CHEQUE WITH ORDER).
CONTACT TONY WINTER 01 636 8210
88 BEDFORD COURT MANSIONS, BEDFORD AVENUE, W C 1

# Personal to the professional —and the beginner

*T[illegible] ideas in person [illegible]*

This article discusses the probabilities of owning a micro computer for professionals, students and [illegible]

[illegible] the odd £800 to spare it [illegible] to justify the purchase of a micro-computer against other priorities. Nevertheless, having a machine at home [illegible] frustration. Given that one [illegible] a micro a wise investment.

Those who have no programming experience should think carefully. If you have the idea [illegible] micro to teach yourself to program, you will need a good machine. The larger the machine the easier it [illegible]. Should you have access to a time share system you should start your programming efforts here. A sophisticated system will be more helpful in indicating where you have gone wrong, it will say "MISSING RIGHT BRACKET", "NO CLOSING QUOTE" or whatever. A micro, on the other hand, will merely give an apparently meaningless "? SYNTAX ERROR". Using a time share system, of course, gives access to a library of programs. These will often include routines and macros which can be incorporated into your own programs. With a micro-computer much time can be wasted programming that which has already been programmed. However, many timeshare systems suffer from being overloaded, a terminal is not free at a suitable time, when you do get the chance to log in it says "SERVICE UNAVAILABLE", or halfway through writing a program "YOU HAVE BEEN LOGGED OUT".

Who are the people that have bought the various micro-computers on offer? The manager of the shop will tell you that the buyers are almost exclusively organisations, businesses and academic institutions. Wistfully he will say "Few people have got that kind of money". There is little point in someone owning a machine unless he or she is interested in programming. You do not need a computer in the home to balance your chequebook and to tell you what food you have in the cupboard. There is no case for the home computer as such. The justification for owning a machine should be *as an aid to professional expertise*. A micro may qualify as a business expense, tax deductable, if you can make out a plausible case to the tax man.

Well, assuming that one can rake up enough money, should one buy now or wait in the hope that the price will come down? It would appear that the price of the basic computer is likely to fall marginally, but that the cost of peripherals will remain high. All current models of micro computers are being superseded by new and improved versions, but these will be geared more exclusively to the needs of the business user. If you have the cash, therefore, you might as well buy now. Otherwise, use the time share system until you have some idea of what programming entails.

The three wise monkeys of the micro computer business are perhaps PET, APPLE and TANDY. These machines are more widely offered for sale but other machines such as the Research Machines 380Z are worth considering if they are being used by others in your field. However, the more popular a machine is the more software there is likely to be available and forthcoming. PET used to stand for "Personal Electronic Transactor" but understandably the makers have let the phrase drop. At present this is the cheapest self contained machine. There is much software and supportive literature but the machine has disadvantages for use at home. It is bulky and too heavy to carry around (it weighs 44lbs). The integral screen is a drawback if you do not care to sit with your nose in front of a CRT. You would have to put up with this one-eyed monster sitting in your room. If you buy a PET with a certain amount of store (so much K) it is not cheap to upgrade it. All the chips are soldered into place. Although the basic computer is cheap, the peripherals, which are more complicated to use than on other systems, are not. If you cannot afford disc drives you have to use the Commodore supplied cassette deck. This is not cheap considering what is consists of: a common or garden modified cassette tape recorder. Pet BASIC has one or two gremlins, for example, you do not always get a linefeed when return is pressed.

The TRS 80 (Tandy Radio Shack) has similar facilities to the PET. You can stand the video screen further away from your face, but having separate units means having flex strung around the place. On the unit we tried, there was always a problem getting programs to load properly from cassette and disc. However, there is an increasing range of available programs and should you consider this machine take level II Basic. Level I would rather cramp your style.

For general programming at home the APPLE has much potential. The top can be easily removed, all the chips can be unplugged and changed. This makes the machine user serviceable and cheaper to upgrade. All that is necessary is to buy the extra chips and plug them in. Peripheral cards are similarly plugged into one of seven slots at the back of the board. About the size of a typewriter, this machine can be put away when not in use. The APPLE is lightweight, you could walk off with it under an arm; it would be unwise to take one's APPLE to an academic institution – even if the machine were screwed to a desk, a student of grand larceny could still remove all the components. The PET is safer from the point of view of vulnerability to theft and damage. APPLE graphics facilities are an attraction but the "mixed graphics and text mode" means a rectangle of graphics with four lines of text at the bottom of the screen Consequently APPLE graphics are useless when it comes to labelling graphs and charts One can label the X axis but not the Y axis (which is the wrong way round for Cartesian coordinates) They may show you a character set in the shop to fool you that this is not so It is possible to draw letters and figures using the High Resolution Graphics (HIRES) and thus label graphs but this means using special disc based software

Unlike the PET the APPLE does not come supplied with lower case but you can get it by paying extra PET graphics are easier to use for low-resolution static displays but the APPLE offers more potential once software is written or acquired With Apple HIRES it is possible to create a shape, plot it on the screen, expand it contract it and rotate it However creating a shape table manually is very laborious – you have to encode every byte with a plotting vector

## First-Timers

Unlike PET the APPLE comes equipped with two paddles These are potentiometers (variable electrical resistors like a volume control) which enable a shape to be moved about on the screen Both paddles can be used together to draw pictures If you have an APPLE you will be also getting in effect a television games machine You can have space invaders bat and ball games and of course chess The built-in speaker allows you to have a program which enables the keyboard to be played like an organ, and a program which plays tunes by itself However music is very laborious to encode unless special software is used The APPLE is not really worth buying for the colour graphics – if a colour T V is owned it will be found that the definition is better on a black and white set Some recent colour sets have a system of tuning which is incompatible with the supplied modulator causing the picture to jump up and down

All microcomputer BASICs are completely incompatible with each other and with mainframe BASICs If you did not know, BASIC started out life as a "Business And Scientific Interactive Compiler" It is now known vicariously as "Beginners All purpose Symbolic Instruction Code" If you had not realized, a computer language like Basic is in itself a computer program In the case of microcomputers, a particular machine's Basic constitutes the operating instructions for that machine and no other It is not possible for example to develop programs on the Apple with the idea of adapting them and selling them to owners of the PET Similarly it will be found that any programs that one has written on a timeshare system are completely untransferable to a micro

In attempting to convert programs, it will be found that the micro BASIC's lack of certain commands is a nuisance no

▶

### A SELECTION OF MICROCOMPUTERS

[illegible] SELECTION IS NECESSARILY ARBITRARILY SMALL AS THERE [illegible] VERY MANY SYSTEMS ON THE MARKET INCLUSION HERE [illegible] NOT IMPLY ENDORSEMENT AS THERE ARE NUMEROUS DE[illegible] ADDRESSES ARE NOT GIVEN SYSTEMS MARKED WITH AN [illegible]ISK MAY BE LOOKED UP IN THE **GUIDE TO ADVERTISERS** IN THIS OR PREVIOUS ISSUES

***ACORN**
Eurocard based 6502 1K RAM BASIC machine code From £80

***ALAN PEARMAN LTD, MAPLE**
Z80A 16–64K RAM CPM S-100 bus, dual floppy disks Intended for use as APL system various APL packages From £1500

***APPLE II III**
II 6502 16–48K RAM optional 5¼ (116K) floppy disks BASIC Pascal RF modulator integral business games educational graphics and other S/W packages From £800
III 6502A 96–128K RAM integral 5¼ floppy disk graphics

***COMMODORE PET SUPERPET**
6502 8 32K RAM optional dual 5¼" (630K) floppy BASIC Assembler Business games educational/graphics/other packages cassette drive (integral) From £[illegible]00 SuperPET is upgraded version with 12" screen 5¼ screen 5¼" disks For business applications From £900

**COMPSHOP UK101**
6502 single board computer 4–8K RAM interface for monitor Kit from £199

**COMPULCOLOR II**
Z80 8 32K RAM Integral 5¼" disk colour VDU Extended BASIC Assembler From £1000

**COMPUTER CENTRE MINIKIT, MAXIKIT**
Both Z80 16K RAM CPM S-100 serial and parallel Min has 5¼" disks Max 8 disks From £[illegible]00, £900 for kits

***CROMEMCO SYSTEM 2**
Z80 64K RAM 5¼" dual floppys FORTRAN COBOL Assembler BASIC Word processing data base management business/industrial scientific packages (multi user) From £2000

**DATA APPLICATIONS DAI PERSONAL COMPUTER**
8080 8–48K RAM BASIC other languages optional colour graphics From £1000

***EXIDY SORCERER**
Z80 8–32K RAM optional dual 5¼ floppy (630K) Extended BASIC Assembler Word processor games graphics From £850

**HEWLETT-PACKARD 85**
16–32K RAM 200K cassette BASIC extensive graphics From £2240

***INTERTEC SUPERBRAIN**
Twin Z80s 64K RAM 5¼ 320K floppy BASIC COBOL FORTRAN APL Pascal From £2000 Various business packages

**LUXOR ABC80**
Z80A 16–40K RAM 5¼" (160K) disk drives loudspeaker BASIC Personal/educational packages From £80

***MSI 6800 I**
6800 16–56K RAM floppy or hard disks BASIC FORTRAN Assembler word processing From £417[illegible]

***NASCOM 1 2**
1 Z80 2 64K RAM BASIC text editor Games personal and From £125 2 Z80 up to 256K RAM BASIC Optional floppy disks Graphics colour Personal some business use From £300

***NEWBURY NEWBRAIN**
Z80A 2K basic plus 4 16K dynamic RAM Various interfaces 16 character LED display (not on basic model) Personal scientific use Hand held From £155 for basic model

**NEWTRONICS EXPLORER/85**
8085 4–64K RAM CPM S-100 BASIC VDU interface Hobbyist use From £300 (Kit)

***NORTH STAR HORIZON**
Z80A 16–56K RAM dual 5¼ floppy disks (360K) BASIC COBOL FORTRAN Pascal commercial scientific educational packages From £1000

**OHIO SCIENTIFIC SUPER BOARD, CHALLENGER II**
SUPERBOARD 6502 4K RAM BASIC keyboard VDU interface Hobbyist use From £160 (single board)
CHALLENGER II 6502 48K RAM dual disk drives mainly business applications From £1500

**PANASONIC**
8085 56K RAM dual floppy disk drives mainly business applications From £4000

**RAIR BLACK BOX I II III**
I 8085 32–64K RAM dual floppy disks optional hard disks CPM Mainly business use From £2900 (II III not really personal computers)

***RESEARCH MACHINES LTD RML 380Z**
Z80A 16–56K RAM optional cassette or floppy BASIC Assembler COBOL FORTRAN ALGOL Educational/scientific applications From £830

***ROCKWELL AIM–65**
6502 4K RAM keyboard and integral printer Optional disks Hobbyist use From £250

***SCIENCE OF CAMBRIDGE ZX80**
Z80A 1–16K RAM BASIC [illegible]
[illegible]
[illegible] applications Kit £79 assembled £99

***SHARP PC–1211, MZ80K**
PC 1211 pocket computer BASIC cassette interface From £85 MZ–80K Z80 16–48K RAM optional disk BASIC Assembler graphics Business personal use From £500

**SYNERTEC SYM–1**
6502 4–64K RAM TV interface Own kim software Hobbyist use From £[illegible]60

***TANDY TRS–80 Level 1, 2**
Z80 4–48K RAM 64K Level [illegible] Optional 5¼ 78K floppys BASIC Level 1 educational enthusiasts Level 2 small business systems From £400

**TANGERINE MICROTAN 65**
6502 based single board 1–48K RAM BASIC graphics various interfaces

**TEXAS INSTRUMENTS TI99/4**
16K RAM Extended BASIC sound generator colour graphics optional speech synthesis Plug in modules for games educational domestic applications From £1000

***TRANSAM TUSCAN**
Z80 single board 8–64K RAM CPM S–100 Cassette and TV interfaces Forms basis of full business system From £150

***VECTOR GRAPHICS MZ**
Z80 56K RAM dual 5¼" floppy (630K) CPM BASIC COBOL FORTRAN Pascal Assembler Business graphics packages

***VIDEO GENIE**
Z80 16–48K RAM BASIC optional floppy disks Personal and some business use From £400

***ZILOG MC 1/05**
Z80 64K RAM dual 8" floppy (600K) BASIC COBOL FORTRAN Pascal business packages From £4000

MAT PRINT, the string functions LEFT$ MID$ RIGHT$ make it very difficult to convert programs which [illegible] substrings to substrings. The lack of PRINT USING means you have to include a formatting routine. In suppressing unwanted decimal places and zeros it is easy to introduce inaccuracies. If you are using a machine like Apple or Pet for scientific work this is something to watch for.

The PET and the TANDY have the drawback that you cannot use your own cassette deck and television. On systems where you can bear in mind the following. You do not need to buy an expensive video monitor if a suitable portable T V is owned. The definition produced is quite acceptable on a well-adjusted set. If a Hi Fi cassette deck is owned this will do fine for storing programs but leave the dolby system switched out. Use either the left channel or switch the unit to mono. Do not put a program cassette into an old battle axe of a tape recorder that your children have been using – it will mangle the tape. Should it be necessary to buy a new cassette tape recorder choose one with a tape counter and a limiter circuit. The latter prevents the overloading of tape – very likely when recording at the maximum gain that is necessary with program tapes.

The magnetic heads should be demagnetized regularly and cleaned with methylated spirit. Ordinary cotton buds are as good as the ones sold for the purpose. The cassette-head cleaning and demagnetizing cassettes sold are a waste of money. If your tape recorder is in poor condition its heads encrusted with oxide and the tape transport mechanism full of dust your tapes can be affected by incomplete erasure and "drop outs". This can result in a loading tape blowing up the operating system the computer ceases to work the only thing to be done is to switch off then on again. If a good reel-to reel tape recorder is available this may be found to be more reliable – you do not have to use cassettes to record your own programs.

If money is no object it would be as well to invest in a disc drive. Not having a disc drive does limit what you can do – there are certain applications which are not feasible with a cassette. However if buying the basic computer breaks the bank the following may be consolation: the disc manual contains just about as much information as the main manual; using a cassette will mean less to learn. You cannot make effective use of the machine until the information in the manuals has been absorbed. So the frustration of not having a disc drive will not be felt immediately. When you do get around to buying a disc system you will have mastered the main system.

Prices of micro computers are uniform across the country little will be gained by going to a major city so go to the nearest acceptable shop. Make a sale appear more likely if the price comes down by £20 or so. It is fairly safe to buy an older machine a demonstration model that the shop wants to get rid of. If a new machine is going to go wrong this is most likely to occur just after you have bought it – use your machine as much as possible during the gurantee period. You may encounter the jargon – ROM Read Only Memory this is a solid state recording containing the machine's operating instructions and it acts like a gramaphone record being played every time the machine is switched on. RAM Random Access Memory the more of this you have the more symbols can be represented in the computer and the larger the programs you can have. It is referred to as so much K. 1 K represents 1024 bytes. A byte is eight binary digits. Here is your checklist for when you get in the shop.

1 Has it got a proper keyboard?
2 Are there any peripherals? How much extra?
3 Can it be upgraded? How much?
4 Software included in the price?
5 Floating point BASIC? Program Renumbering? Lower Case? Graphics?
6 Discount? Deliver it free of charge?
7 What if it goes wrong? ■

---

• *The author [illegible] and is currently reading [illegible] at the University of Sussex*

## Old tricks for new Pets...

[illegible] is a [illegible] ROM for the 4000/8000 Pets [illegible] commands [illegible] improved [illegible] HELP TRACE [illegible] plus PRINT USING plus four extra disk commands [illegible] plus extra editing commands SCROLL MOVE OUT BEEP and KILL plus user definable soft key [illegible] control characters on key [illegible] for the 8032 or [illegible] for the 4016/4032 [illegible] plus VAT

## New tricks for old Pets...

DISK O PRO is a FOUR KILOBYTE Rom that upgrades 2001/3000 Pets but lets you use all your old software including Toolkit. As well as REPEAT KEY and PRINT USING you get all the Basic 4 disk commands CONCAT DOPEN DCLOSE RECORD HEADER COLLECT BACKUP COPY APPEND DSAVE DLOAD CATALOG RENAME SCRATCH and DIRECTORY plus extra disk commands INITIALIZE MERGE RECALL and SEND plus extra editing commands SCROLL MOVE OUT BEEP and KILL plus PET user definable soft key 80 characters plus program scroll up and scroll down. We recommend the 4040 disk or upgraded 3040 for full benefit of disk commands. Ask for Model DOP 16N for new Pets 2001-3032 and 2001-8 with retrofit Roms & TOOLKIT [illegible] plus Vat other models available

FRONTO PET hard/soft reset switch for the 3000/4000 Pets. We don't think you'll "crash" your Pet using our software but if you do the Fronto-Pet will get you out! Also clears the Pet for the next job without that nasty off/on power surge [illegible]

## and no tricks missed!

KRAM [illegible] Random Access Method [illegible] disk handling for 3032/4032/8032 Pets with 3040/4040/8050 disks means you retrieve your data FAST by NAME no tracks sectors or blocks to worry about. Over 2 500 users worldwide have joined the "KLUB"! Now you can too at [illegible] price [illegible] plus Vat

SPACEMAKER All our Rom products are compatible with each other but should you want say Wordpro with Kram or Disk-o-pro with Visicalc then SPACEMAKER will allow both Roms to access one Rom socket with just the flip of a switch for £22 50 plus Vat

We are sole UK distributors for all these fine products. If your Pet dealer is out of stock they are available by mail from us by cheque Access/Barclaycard [illegible]

# Calco Software

[illegible] Surrey [illegible]

# INTEGRATED SMALL BUSINESS SOFTWARE ISBS

Professional Business Packages for Microcomputer systems include

- PAYROLL
- STOCK CONTROL
- ORDER ENTRY & INVOICING
- COMPANY SALES
- COMPANY PURCHASES
- GENERAL ACCOUNTING
- NAME & ADDRESS SYSTEM

Available as individual modules or complete system to run on RAIR BLACK BOX NORTHSTAR HEATH CROMEMCO DYNABYTE IMS 5000/8000 ALTOS ALTAIR, SUPERBRAIN MICROMATION and most other 8080 based systems

Contact Lifeboat Associates 32 Neal Street London WC2 or your nearest dealer

GRAFFCOM SYSTEMS GROUP
52 SHAFTESBURY AVENUE
LONDON W1 01 734 86?2

# Mainstream and Microstream

*This article is [illegible] that [illegible]*

For a long time the microcomputer community has ignored the mainstream computer world. It has appeared that mainframe and minicomputers with their air conditioned rooms, large-scale main and backing store and hordes of subservient programmers and systems analysts (plus an even larger community of operators, keypunch girls etc.) has very little to offer the personal computer owner who has to be his own Data Processing manager, Analyst, Programmer and Operator all at the same time with little help. This is further enforced by the way in which the different functions in the main profession are rigidly compartmentalised, and different career progressions have become established, precluding lateral transfer. This was very necessary in the nineteen sixties when computers were large, unwieldy and incredibly expensive. For companies and organisations to justify the expense of not just the computer but the building and services needed to maintain it in the environment to which it had become accustomed as well required forcing the absolute maximum amount of work possible through the machine. This required a dedicated and extremely well-disciplined organisation to ensure that this very expensive machine was in use absolutely all the time. This was very necessary when the new computer was often the largest investment the company had ever made.

As computers became cheaper and much more common, different career patterns developed for the various staff members involved. Computers were originally large and cumbersome and had to be programmed in machine-code directly by their users (usually scientists and engineers who wished to perform complex calculations). Having prepared their program and data by punching the information on cards or paper tape, they then queued up to run it on the computer in turn. It took many hours to prepare the program and data, to load it into the computer and to run it. There was no large scale storage available, so both the program and data had to be loaded each time a run was attempted. Also there was no **monitor** or other form of **operating system**, so the user had to control the execution of the program. There was no need for complicated instructions as to how the program was to be processed since the user had to process the whole operation himself.

As computers became more common the number of computer users grew very rapidly, particularly as the introduction of high level languages, such as FORTRAN, allowed scientists and engineers to write programs in a form which was very close to the way that they were already used to defining their problems.

> *'The programmer was, by now, totally isolated from the machine'*

As the number and complexity of the programs to be run increased, considerable effort was expended to improve the total throughput of the computer. A simple operating system was provided to • speed up the progress of a program from stage to stage by • automatically loading in the compiler (and other systems programs automatically) when needed, and a whole new breed of systems programmers emerged. Backing store in the form of magnetic tapes and later disks were added to provide faster access to both programs and data.

To keep track of all this the operating procedures became much more complicated, and specialist operators were employed to run the computer. This in turn meant that the Operating System had to become much more comprehensive, since the user himself or herself no longer had access to the switches and indicators which made up the operator's console. All input had to be prepared beforehand, and given to the Operator in an easily managed form, usually a deck of punched cards, which included not only the program and data, but also some means by which the computer could recognise the programmer and details of how the computer was to process the job and which options, if any, were to be selected at various stages during the progress of the job.

The programmer was, by now, totally isolated from the machine, which could only be glimpsed through windows in the Computer Room, and certainly never touched by anyone except the operations staff. This was perfectly adequate for many scientific, engineering and commercial applications and the use of computers expanded rapidly in these areas. There were, however, many cases where the user could not decide on what action he wished the computer to take until he had seen, at best, some of the results. This was very awkward, and typically meant that a job had to be run in several stages, storing the intermediate results on backing store until they could be processed further. Since jobs were processed in order, and the next job could not be submitted until the results of the previous one had been studied, possibly in some detail, it could often be several days before the final results of the calculation were obtained. If information could be supplied to the user while the program was actually running, he could decide what action he wished the computer to take, and the progress of the job would be greatly improved.

To allow this sort of interaction, **time-sharing** computer systems were developed so that users could once again have direct access to the computer whilst their program was executing; this time, through a series of terminals located at convenient places around the user areas. This was fine, except that the computer languages developed for the batch processing environment, such as FORTRAN, ALGOL 60 and COBOL, were found to be inappropriate for writing programs which were to be written and tested from a terminal. BASIC was therefore developed to fulfil this need. At the time Editors* were very crude, being designed principally to allow the user to maintain programs and data on backing store rather than as large card decks, which were liable to be shuffled or damaged and

---

* **Editor's note:** Are those days really over?

## Background

would require considerable effort to reassemble. Only complete lines could be inserted or deleted so if one character required changing the whole line had to be removed, and retyped. This followed through into BASIC where lines of source code are recognised by their sequence numbers. No further identification is required since GOTO and other instructions which refer to specific lines of code, also use the sequence number in the same way that the assembler programmer uses addresses within the code.

### Flexibility

It was soon found that terminal access allowed considerable flexibility not only when running programs but also in such tasks as editing files and preparing jobs to be submitted in batch mode. This has allowed most computer sites to greatly reduce their reliance on both punched cards and paper tapes. This then, was the situation when microcomputers appeared in the late seventies. Because the initial machines had very little memory and, at most, a very simple cassette storage facility, the most appropriate user interface was a BASIC interpreter which would also act as the computer's supervisor program to be entered immediately the power was switched on.

The BASIC interpreter was often stored in Read Only memory so that the user did not have the bother of reading it in from tape every time that the computer was used. This arrangement has developed over the past three years to give some powerful problem solving tools, in computers for personal use. The memory capacity has now expanded to the maximum possible with the 8-bit microprocessors, and the slow cassette tape backing store has been superseded by the faster, and usually more reliable, floppy disks.

*'The basic structure of the machines, however, remains much the same'*

The basic structure of the machines, however remains much the same. This sort of mchine accounts for the major proportion of current microcomputer sales with each of the three main manufacturers Tandy Apple and Commodore claiming to have sold in the order of 100,000 computers. BASIC is used to write the main applications programs which may call machine-code routines, if necessary. This is usually required to circumvent deficiencies in the BASIC interpreter to allow proper control of special peripherals, or to speed up complex or frequently used sections of code. Since the main program is interpreted any input error is likely to return control to the interpreter together with a BASIC error message. Whilst this is very useful to the programmer, it can be very confusing to a user who has bought the computer and the package to perform a specific task and who will not necessarily know anything about the normal use of computers. It is for instance, possible to drop several computers out of the user program and back into the BASIC interpreter's command mode by typing return without having typed any other characters first – with little if any warning. This can be particularly confusing since it is then possible for the naive user to wreck the program in memory, and even the information stored on disk without knowing what he is doing.

If, on the other hand the program is compiled, and the program is distributed as object-code, it is easier to build in checks for input errors and to recover from some of the more likely execution errors, such as an attempt to divide by zero, or an arithmetic overflow. This is what is now being provided by several of the manufacturers of personal computers. Their machines are now available with most of the memory space filled

[illegible]

From the I. P. Sharp Newsletter published by [illegible] APL Specialists, I. P. Sharp Associates. Serious APLers can contact them at 132 Buckingham Palace Road, London SW1W 9SA

*A full tutorial series on APL by Alan Pearson [illegible] in previous issues of Com*

## Background

with random access memory with only a small 'bootstrap' program held in read-only memory This allows the user to choose the system he wishes to run on his computer, so he may use one or more versions of BASIC change to a compiled language such as FORTRAN or PASCAL or load in a special program to perform his desired task directly This flexibility would not be possible if considerable portions of the program are held in read only memory since a large proportion of the available memory would not be of use except when that particular system is in use

It is possible to arrange for different sets of memory to be switched, either manually or under software control This is quite complex both to design and to use, and so far has not found much popularity with end-users, a simple machine interface being much more desirable Also it is much easier to circulate new issues of system software if all that is needed is a new diskette and a revised manual rather than a series of read-only memories which must be plugged into the right sockets once the old 'chips' have been removed This is a somewhat daunting task for anyone not used to handling this sort of component

### Changes

Already the microcomputer world is showing great changes from the early pioneering days In most cases the memory installed on new microcomputers is close to the maximum which can be connected to the central microprocessor It is therefore no longer absolutely essential to compress programs into the absolute minimum possible memory space (in practice since the microprocessors were originally designed when memory was much more expensive many useful programs are a tight fit because memory areas reserved for special functions such as for instance the microprocessor system stack are inadequate for the size of program being run There is therefore little opportunity for sloppy programming)

> *'This allows the user to choose the system he wishes to run on his computer'*

The biggest change however has been the widespread introduction of floppy disk drives and the ability to transfer programs simply and quickly on diskettes Large quantities of information can be accessed very quickly on any machine with suitable disk drives unlike cassette tapes which are much slower and must be searched sequentially for the required material

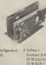
The object of this article is to show that the microcomputer world like its big brother the professional computer world is changing very rapidly Ideas that are now current will seem very outdated in a year or two's time To attempt to formulate long standing policies on current technology is only going to cause difficulties in the future Microcomputers have been so successful so far not only because of the flexibility they allow in their use but also because the people that buy, and use them have been able to *adapt* to these changes as rapidly as new products have been announced Indeed in many cases it is the end user who has provided the encouragement for the development So long as this flexibility is maintained the use of the microcomputer will develop as rapidly as it has done over the past three years Otherwise if for instance it is no longer possible to purchase machines which can be adapted to meet the user's requirements he will look elsewhere for a solution to his problem and the present microcomputer community will be ignored It is therefore necessary to provide a wide range of adaptable systems which can be used in many different ways by the end-user without recourse to distant and expensive technical services It is after all the user who supports the whole industry with the prices he is prepared to pay for the machines he purchases ■

---

• Dr Martin Beer an editorial advisor to Computer Age is at the Liverpool University Microcomputer Laboratory

# S 100

Do You Have All These Facilities
On Your S 100 System,
With Just Two Boards?



1 Z80A CPU 2 or 4 MHz Operation
2 Z80A CTC 4 Channels
3 Z80A SIO 2 RS 232
4 Z80A PIO
5 Disk controller Takes up to 4 disk drives single or double density operation
6 64k Bytes of memory
7 EPROM Programmer
8 Real time clock
9 Software -
Standard 2k Monitor
CP M Cold Start Loader
CP M BIOS (1 4)

Prices

| | |
|---|---|
| FDC 1 Board | £485 50 |
| Expandoram | £327 56 |
| Mother Board | £ 42 00 |

*All prices exclude VAT*

**SEMEL**

**MICROCOMPUTER-HARDWARE SOFTWARE**

3c, BARLEY MARKET ST ,
TAVISTOCK DEVON PL19 0JF
Tel TAVISTOCK (0822) 5247 Telex 45263

**NO FRILLS, NO GIMMICKS, JUST GREAT PRINTER DISCOUNTS!**

**Epson MX80**

*9x9 dot matrix Logic seeking Bi-direct onal 96 ASCII characters 64 graphics and 8 International characters Centronics I/F with opt on RS232 and IEEE 488*

£359 + VAT

**NEC Spinwriter**

for the professional word processing system

£1390 + VAT

*Model 5510-RS232 Model 5530 Centronics 8 bit par 128 ASCII chs 5 copies Friction or Tractor fed 55 chrs per second*

**OKIDATA**
MICROLINE 80

The small, quiet, light, highly dependable printer with three way paper handling Single sheet/roll/pin feed Assured reliability and quality

£349 + VAT

**Qume**
SPRINT 5

Daisy wheel quality printer *Designed especially for data processing applications*

£1450 + VAT

**NORTHAMBER LTD**
GREAT OAK HOUSE, ESHER, SURREY, KT10 9SR
Phone: ESHER (0372) 62071 & 01-786 2072
*Full details on request. Prices exclude VAT & delivery*

# Time For Retail To Wag The Industry

*The Computer Retailers Association — a pearl looking for a world to be its oyster*

Ho hum. I've sat here in front of my typewriter for half an hour now trying to think up something stunning, or witty, or even contrived to place before you as the introduction to this piece.

But alas, the muse this month is not upon me. No quaint analogies of software and record players, no lyrical hyperbole (?), no snap, crackle or pop.

Why so? a voice, which for the sake of artistic licence I have decided to hear within my head, asks of me. No answer comes readily to hand. And yet there is perhaps the shape, the outline of the beginnings of a thought, of a form of words that hangs tenuously around a nagging doubt. Quite what that doubt is I have yet to determine fully, yet somewhere it exists within and about my synapses.

The shape of the doubt is thin as yet though it seems to grow rounder daily. The colour of the doubt is grey, but may be getting darker. The reason for its existence? That is hardest to pin down, for nail the reason firmly to the floor and it becomes a problem, and a problem can be addressed, solved, and learned from. But somewhere the reason is geared to both this ever loving industry of microcomputers, and this ever loving country (?) with its quirks and oddities.

To dispense with the latter first (a classic piece of random access journalism) I'm not sure that I would wish to change anything about the country fundamentally. I'm certainly not sure that I would like to have my thinking and attitudes delineated as well as my actions. At the same time, we seem to have drifted (I don't actually remember running joyfully, even in theory) into a situation like that of a newborn baby that is placed in a vacuum chamber and then has its backside smacked to teach it to breathe. The necessary raw materials just don't happen to be available.

So with this country. We crawl through the uncharted lands of change. Change from the first industrial revolution and on to whatever it will be that we collectively want to create as our future. In that process of change there are inevitably casualties. Both people and companies suffer, not least because some forms of industrial activity become elevated to the heights of being anachronistic. As with people who gently reach the full span of their years, so such industries should be allowed their right to die. It can be with dignity, pathos, drama or whatever, but dying is allowed and, in purely industrial terms, is even to be encouraged. Certainly, such dying industrial activity should not deprive the young industries from their opportunities, their food supply. (It always struck me as odd that dead Pharaohs were loaded down with food for a 'journey' that they had already made – if they were going to make it.)

> *'dying is allowed and, in purely industrial terms, is even to be encouraged '*

We however seem beset with the idea of not only leaving food around for our dead Pharaohs, but of also trying to fill up the corpses intravenously, hoping against hope that something might happen, might turn up. All the while the children look on, hoping. The adolescents, having learned from observation, practice playing dead in the hope of attracting attention. (But given that sufficient practice will always make perfect, by the time they attract attention they have often learned how to play dead for real.)

One of those children is, of course, the industry surrounding microelectronics, microcomputers and small systems based on those technologies. It is here, along with many other new technological developments, that the new vitality, sense of direction and other wonderful buzz phrases of future hope will grow, if at all. They provide the tools through which we can create the whatever future we want, that we do want.

Right, enough of political diatribes per se, and back to the former reason for doubt.

The microcomputer business in this country, even though it has some fine examples of home produced equipment, is predominantly based upon the importation of foreign kit. This is perhaps the first example of how our children are starved of their food. Imagine every UK manufacturer thumping away at world markets and taking a goodly share of the spoils there — with just a little more of the right sort of encouragement.

Be that as it may, the large portion of the business that is based on imported equipment is also important to one of the children of this country. It has importance because the microcomputers that the companies within that sector sell usually only become valid as products as the basis of a system. It is here in system design and engineering that the UK companies have something both valid and important to offer, and where they need the support of enlightened 'parents'. That support does not even have to take the form of the direct supply of food in the shape of money. All this particular child needs at the moment is a liberal dollop of fertiliser (I refrained just in time from writing manure) that will help the food to grow.

Perhaps unsurprisingly, the food I refer to is boring things like fiscal policy and the manure (sorry, fertiliser) I refer to is an alteration to same which will allow all industry to think in terms of investing in much needed plant, equipment and other likely bits and pieces *now*, *before* the recession actually ends. That way, industry in general will be better placed than in other post recessionary periods to grab a slice of the subsequent boom (that goes double, with bells and whistles on, for our indigenous microcomputer manufacturing industry).

Such an alteration could have long term consequences, and worked aright some of them could even be beneficial. While they wouldn't make the recession go away, a more soundly based future in the marketplace might stop, or at least play a part in helping to stop, the tendency of some companies in the business of selling microcomputers to buy market share by cutting their margins, and so cutting the prices.

# Viewpoint

I have waxed long and lyrical about this in the past and don t intend to do so too much this time I have done the same if to a lesser degree about the Computer Retailers Association and here I would like to add a bit or two about what it might do concerning price cutting and other activities

Recently (Issue 13) I wrote in these columns about the CRA or what appeared to be the apparent lack of the CRA The Association responded and I found contrary to my postulation that *rigor mortis* had not in fact set in Come said Hon Tres Stanley 'and see us come talk to us On the basis of if they re mug enough to ask me etc etc off I went with a later to-be-disregarded pre-written, speech in hand and spoke to them saw them and found them to be alive, well but perhaps a little under-nourished even for a body so young

For just over a year the Association has been in existence and during that time it has wrestled with all the problems that such start ups have you know setting up a secretariat recruiting membership and the like all on a limited budget Unfortunately the only outward result of this work was an apparent still birth and a still meagre membership

Now I m in favour of the CRA – at least in theory I am – for it can serve both the customer and the companies in the business to advantage It also runs the danger of becoming a micro buffs drinking club and the even greater danger of being seen to be such a club These are dangers that it is becoming aware of

The way in which the Association can serve the customer (who after all is the ultimate source of revenue happy bank managers and food in the kids stomachs) is by providing the customers with some form of either and or *implied or written guarantees* of service and support That doesn t mean just hardware maintenance capabilities but *all* the pre sales and post sales capabilities that selling a computer entails This would involve not only having good staff available for the work but could also include – perhaps – some form of insurance policy for customers to help guard against such eventualities as the sad but inevitable demise of a member company

It would help the members themselves by providing a forum for information exchange between them which so long as the information was sound and not flatulent could help keep the companies in business (No that does not necessarily imply a cartel) For example the Association would be the ideal forum for statistical data on the performance of the business as a whole collating quarterly sales figures from members together with rolling projections on future business This suggestion has prompted the response I m not telling my competitors my business figures to which the answer is two fold It doesn t take too much effort to get at least a reasonable fix on the performance of a company especially if it is a direct competitor where all the working rules are basically the same – somehow competitors *know* when a rival is doing well or badly The more important answer is the second one for if there is a sound statistical basis to the business that is collated by as such a third party *then the all important financial institutions are actually going to believe what* is happening with micros and get a numerological feel for the potential of the business and this they can understand That could be extremely useful in maintaining the future of the industry and therefore affect the interests of the customer in a positive manner

All this depends to some extent at least on the Association being able to attract to membership as many as possible of the companies operating in the industry Success here has been less than glorious to date and that s a shame There seem to be a million reasons why this should be some based on the £300 membership fee for nothing tangible philosophy through to the already mentioned view of the CRA as nothing but a drinking club Some won t join because of the word 'Retail in the Association s name even though existing members perform the same business functions

It is therefore up to the CRA to overcome these objections and promote itself into the industry in the same way as other Associations have done get in the members provide the services and keep the customer satisfied

That at least is wot I told em ■

- *Martin Banks has now joined [illegible] Computerworld a weekly publication for the computer industry*

## The CRA

The membership of the Computer Retailers Association has now gone up to 25 of the foremost dealers in its *first year* and rapid recruitment is now expected to take place in 1981

The Association through its code of practice is determined to enhance the reputation of Computer Retailers by enforcing good practice wherever possible and does act as arbitrator in the case of complaints Customers dealing with CRA members therefore have recourse to the Association and this applies when dealing with the following companies who are CRA members

Intex Datalog Ltd
Eaglescliffe Industrial Estate
Eaglescliffe
Stockton on Tees
Cleveland TS16 0PN

Datron Micro Centre
Datron Interform Ltd
2 Abbeydale Road
Sheffield S7 1FD

Petalect Electronics Ltd
33 35 Portugal Road
Woking
Surrey GU21 5JE

Keen Computers Ltd
58 The Poultry
Nottingham

Tradata Micros Ltd
Smithfield House
Digbeth
Birmingham, B5 6BS

Microdigital Ltd
25 Brunswick Street,
Liverpool L2 0PJ

Xitan Systems
23 Cumberland Place
Southampton S01 2BB

Newbear Computing Store
40 Bartholomew Street
Newbury Berks

Crystal Electronics
40 Magdalen Road
Torquay Devon

Sintrom Microshop
14 Arkwright Road
Reading
Berks RG2 0LS

The Byte Shop Computerland
Little End Road
Eaton Socon
Cambs

B & B (Computers) Ltd
Suite 1
124 Newport Street
Bolton.

[illegible] Radio Ltd.
[illegible] Station Road
[illegible]
[illegible] M31 1JX

Camden Electronics
First Floor
462 Coventry Road
Small Heath,
Birmingham, B10 0UG

Great Northern Computer
Services Ltd ,
116 Low Lane,
Horsforth,
Leeds

Comart Ltd
P O Box 2,
St. Neots
Huntingdon,
Cambs

Equinox Computer Systems
Ltd
Kleeman House
16 Anning Street
New Inn Yard
London EC2A 3HB

H B Computers Ltd
22 Newland Street
Kettering
Northants

Sheffield Computer Centre,
225 Abbeydale Road,
Sheffield S7 1FJ

Vlasak Electronics Ltd.,
Thames Building,
Dedmere Road,
Marlow
Bucks SL7 1PB

Lion Micro Computers,
Lion House
227 Tottenham Court Road,
London W1P 0HX

T & V Johnson
(Microcomputers) Ltd
165 London Road
Camberley
Surrey GU15 3JS

DBM Systems & Software
58 Victoria Street
Bristol 1

Micro Computer Centre
28 Sheen Lane
London SW14

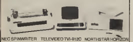
H B Computers (Luton) Ltd ,
(formerly Isherwoods)
112 Leagrave Road
Luton Bedfordshire

Further enquiries regarding membership may be sent to the Secretary Computer Retailers Association Owles Hall Owles Lane Buntingford Herts SG9 9PL Tel 0763-71209

- From a CRA news release

# BUSINESS APPLICATION SOFTWARE

## WORD PROCESSING


NEC SPINWRITER TELEVIDEO TVI-912C NORTHSTAR HORIZON

# Wordstar

## Probably the most powerful word processing package available on any microcomputer

**WordStar features include**
**Print Spooling** Simultaneous printing and editing
**Help messages** comprehensive prompting eliminates the need to refer to a manual Four levels user selectable
**Video editing** text is displayed on a screen any change is immediately displayed The size of the document being edited is limited only by disc capacity
**Powerful editing commands** text can be inserted deleted moved copied or read from files A string of data can be found and replaced with other data
**Word-Wrap** virtually eliminates the need for carriage returns A word too long to fit at the end of a line is automatically moved to the next line
**Dynamic page break display** shows the location of the end of a page on the screen Dynamically updated as changes are made
**Print enhancements** Boldface Double Strike Underline Strikeout, subscripts superscripts variable character pitch variable line height and alternate type style or ribbon colour are all possible using a daisy wheel printer
**Flexible formatting** the user can choose either a ragged or justified right margin or mix both
**Flexible pagination** user control of page length, top and bottom margins heading/footing/page number locations and pagination directives
**Hyphen-Help** alerts you when the last word on a line is too long to fit. You can choose between hyphenation or moving the whole word to the next line
**Decimal Tab** allows columns of numbers to be typed as easily as operating an adding machine **WordStar** will line-up the decimals automatically
**Paragraph Indent** temporarily sets the left margin to a tab stop so that documents with multiple indentations (like outlines) can be typed easily
**Program Execution** allows a program (such as an operating system utility) to be executed with automatic return to **WordStar**
**MailMerge*** (optional) is a powerful file merging tool It can combine a file containing names and addresses with a file containing letter text inserting data where variables are specified even in mid-paragraph It enables personalised form letters to be created with a specified salutation and/or closing The same data file can be used for both form letters and mailing labels
**Multiple copy printing*** allows the same file to be printed more than one time automatically
**Chained printing*** a file name can be specified within text The file will later be printed automatically
*Items are a feature available in the optional Merge-Print module at a cost of £65

**MicroPro Products**
**WordStar** is a screen-oriented text editing and word processing program
**Software /Manual**** £175/£20
**MailMerge** (**WordStar** required) is a powerful file merging tool Variables from data files are inserted in specified places within text and requstified Includes nested and chain printing capabilities
**Software*/Manual** £65/£10
**DataStar** is a system for data entry retrieval and updating
**Software /Manual****, £145/£20

## STOCK CONTROL

ANADEX DP9500 TELEVIDEO TVI-912C NORTHSTAR HORIZON

# Inventory

## Comprehensive Stock Control, Sales and Purchase Management System

The **INVENTORY** package consists of a suite of programs (menu driven) written in a hybrid of North Star BASIC and assembler All input is screen oriented making use of direct cursor addressing and protected fields All field data input is in carefully defined screen areas This ensures that the operator cannot exceed given input field lengths Further all input is verified by input type (alpha numeric alphanumeric) and field range where applicable

**INVENTORY** is suitable for most medium sized inventories and is designed to run in typical retail and wholesale environments **INVENTORY** maintains purchase and sales ledger control as well as stock control by use of built-in invoice and order processing Incorporated are special features which facilitate generation of:

1) Customer name addresses and telephone lists by customer type
2) Quotations based on prices associated with customer type
3) Price lists by customer type
4) Vendor name address and telephone list
5) Sales (customers) and Purchase (vendors) statements.
6) Sales and Purchase remittance advice notes
7) Sales and Purchase accounts analysis listed alphabetically by account number On the last page a summary of Purchase or Sales totals for current 30 days 60 days and 90+ days is printed
8) Sales and Purchase reminder letters Provision is made for two different versions The default paragraph for each is input during INSTALL Optionally prior to printing a Reminder Letter the user may enter a specific paragraph related to that Letter Should the user decide not to use the default paragraph facility then each Reminder Letter would have a unique paragraph input by the user

Additional features include
9) Ability to customize **INVENTORY** for user's particular VDU and printer
10) Can print invoices order acknowledges copy invoices credit notes and packing list
11) Generates statements and remittance advices.
12) Generates reminder letters first and second.
13) Generates orders and order copies.
14) Utilities for
a. Percentage uplift of cost, landed and list prices
b Reset turnover count associated with each product.
c Modify existing invoice quotation and purchase order numbers
d Modify client type discount values
15) Stock record maintenance (add modify delete or leave) on all stock record fields
16) Account record maintenance (add modify delete or leave) on all fixed record fields
17) Transaction posting to client account. Facilities cash in/cash-out and other necessary transaction adjustments Note. ORDER and INVOICE produce their own specific transaction records Transaction categories (e g invoice cash receipt etc) are identified by transaction type
18) Stock analysis report, flags products in excess and to be ordered

**Future Enhancements**
The following enhancements are planned for the near future
1 Extending the system to work in conjunction with a General Ledger package to add Bank Account Maintenance and Balance Sheet generation
2 System extension to support hard disk(s)
3 Timesharing
4 Compatability with the CP/M operating system
**Inventory Package Software /Manual** £295/£16

***Price of Software includes manual **100% credit if software is purchased later**
Prices and specifications subject to change without prior notice
**DEALER ENQUIRIES WELCOME — PLEASE WRITE OR PHONE FOR LATEST CATALOGUE**
*PLEASE SEE BACK COVER FOR FURTHER DETAILS*

**INTERAM**

**INTERAM Computer Systems Limited**
59 Moreton Street, London, SW1
Tel 01-834 0261/2733 Telex 925859

# A PILOT PROJECT

## Part II

# Implementing the Language

*In a previous article* (**Issue 14**) *David Parkinson discussed the experiments in Computer Aided Learning at Modern Tutorial College which led to the development of a machine code program called MTC PILOT to permit the running of PILOT programs on the Commodore PET In the present article Michael Bolley the author of MTC PILOT, discusses the design and writing of such a program with particular reference to MTC PILOT*

Having taken the decision to enable a computer system to understand a new programming language (whether it be assembler code or a high-level language) it is important to begin by clarifying one's ideas about precisely what the implementation software will be required to do The first part of this article is concerned with providing such clarification

The software required for the implementation of a programming language will have to be capable of handling the following stages in the processing of a source program written in the given language

(i) entry and editing of the source program text including storage and retrieval using a permanent storage medium such as tape or floppy disk

(ii) translation from the source language into a form more directly usable by the computer

(iii) execution of the actions specified in the source program.

These three aspects of the system can be handled as three distinct phases, each phase being carried out on the whole program before proceeding to the next phase or they can be combined in various ways *The different possible combinations of these stages characterise the different types of translators which can be used*

Peter Webb

*Left to right Michael Bolley David Parkinson W B Moore David Parkinson is head of the department of Physics and Computing Science and W B Moore is the Principal of Modern Tutorial College.*

Aspects (i) and (ii) can be combined into a single phase but this results in very weak editing facilities An example of such a system is the simple 'load and-go' assembler to be found in the Extramon monitor for the PET, where no labels are permitted and each line is assembled directly into the specified memory as it is entered into the machine Although the system is useful for assembling short routines it is very laborious to insert even a few bytes into an already entered section of code

In any case such an arrangement is not suitable for dealing with high level languages which involve complex interrelationships between separate lines of source text Thus stage (i) must be handled as a separate phase from stages (ii) and (iii) of the process An editor which can be located in an entirely **separate** program from the remaining stages is used to handle the first phase of the process The editor is discussed further later in the article

We may treat aspects (ii) and (iii) either as *distinct successive* phases as in a *generative translator* or combine them so that both phases are carried out on *one* line of source text *before* the next line is treated, as in an *interpretive translator* These two principal types of translator are now considered

### Generative Translators

In a generative translator since phase (ii) the translation process does not result in immediate execution of the actions specified in the source text the translator produces (or 'generates') new code the **object code** which is the raw material from which the subsequent actions performed in phase (iii) are determined *Compilers* and most *assemblers* are of this type Two examples of such sys tems on the PET are the TCL Pascal package and the Commodore Assembler system.

Assemblers are reasonably straightforward to produce because of the virtually one to one relationship between the source language (assembler code) and the object language (machine code). Also the lack of complex control structures helps to make life easy. For example, conditional assembly is a relative luxury but few high-level languages could do without some form of IF ... THEN statement.

On the other hand, compilers are perhaps the most complex of all translators and tend to be extremely difficult to construct in comparison with the other forms of translator. The compiler must be capable of generating code to deal with all run time contingencies, including the detection of run time errors, and to deal with procedure calls including those of a recursive nature. These are just some of the problems to be faced by the compiler writer.

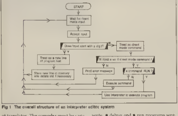

START
Wait for direct mode input
Accept input
Does input start with a digit?
N
Y
Treat as direct mode command
Treat as a new line of program text
Is input a valid direct mode command?
N
Y
Store new line in memory and delete old if necessary
Print error message
Is command RUN?
N
Y
Execute command
Use interpreter to execute program

**Fig 1 The overall structure of an interpreter editor system**

### Interpretive Translators

Interpretive translators do not generate object code but rather perform each action specified in the source text *as soon as the meaning* of the particular source text statement has been ascertained. The most obvious examples of such translators are the interpreters of high level languages such as the PET's BASIC interpreter which resides in ROM. However, there are other examples of interpretive translation. The process whereby a microprocessor carries out a machine code program is essentially of this type, machine instructions being translated into actions by the agency of the chip's internal microprogram.

Interpreters are the simplest form of translator, both as regards internal construction and ease of writing. Each type of *statement* has a *subroutine* which performs it as part of the interpreter, and all kinds of control statement can be dealt with fairly straightforwardly since the values of all variables, expressions, etc are known at the time when translation of a statement takes place.

## Interpreter

### Compilers v Interpreters

Because of the ease of interpreter writing compared to that of compiler writing, the choice of which option to adopt is likely to be clear, on those grounds alone, for anyone without experience in translator construction. Nonetheless, it is worthwhile to consider other factors which can influence this decision. So far we haven't even given a mention to the person who is to be the user of the system – the programmer who is to • design • write • debug and • run programs written in the given source language. His needs are of great importance, and considerable weight must be given to them by the author of the implementation software.

The principal advantages of using a compiled language are its high speed of execution and the fact that most bugs can be trapped at the compilation stage rather than being discovered during a program run. However, considerable difficulties are often encountered, especially by novice programmers, in finding and correcting errors in the source program, particularly those encountered at run time, as the nature of the system prevents precise pin pointing of erroneous code. A further disadvantage of compiled languages when used on microcomputers is that the generated code is frequently much longer that the corresponding source program, thus limiting the size of program which can be handled by the system.

Interpreted languages execute more slowly that compiled ones, since the translation phase has to be done in addition to the actual execution process. The main strength of interpreted languages is their capacity for powerful error reporting and other aids to program debugging such as easy access to the current variable values immediately following a program run. This is not possible for compiled languages since the variable identifiers and also the source text line numbers (if any) do not appear in the object code which is executed at run time. The relative convenience and ease of use of interpreted languages should also be noted – this aspect is particularly important when beginner programmers are likely to be using the system, as will be the case in many educational environments. For these reasons MTC PILOT was written as an interpreted language, and most of the remainder of this article will be devoted solely to interpreted rather than compiled languages.

### System Structure

The **implementation software** for an interpreted language will consist of two parts: the *editor* and the *interpreter*. When a program is not actually in the process of execution, all user input will be handled by the editor, which must be capable of distinguishing and acting upon the following types of input from the keyboard –

(1) a new or amended line of source program text

(2) a command to the editor, such as LIST, LOAD, SAVE

(3) the command 'RUN' to start program execution

The overall structure of the system is shown in **Figure 1**, which indicates how these three types of input can be distinguished and how each type is dealt with.

### Selection of Editor Commands

Careful consideration needs to be given to the collection of editor commands (or direct mode commands) to be included.

The bare minimum which one could get away with would be equivalents of the BASIC commands NEW, LIST, SAVE, VERIFY and LIST. Of next importance is a facility for obtaining hard copy of the source program text on a printer. Since MTC PILOT does not permit the use of file commands such as OPEN, CLOSE and PRINT#, the PET BASIC instructions for obtaining hard copy, OPEN 1,4 CMD1 LIST followed by PRINT#1 CLOSE1, have been replaced by the single command PLIST.

Another facility which ought to be included amongst the direct mode commands is a method of obtaining the current value of a variable subsequent to a program run. This is fairly straightforward to do with an interpreted language and is of great assistance to a programmer in debugging faulty programs.

Other editor commands which should be considered are those which enhance the ease of entry and editing of programs. These might include an AUTO line number feature, RENUMBER and block DELETE commands, and software key REPEAT on and off commands. Also some way of leaving the interpreter editor system (other than powering the system off!) is desirable if not strictly essential. For example, in MTC PILOT the command BASIC causes the PET to return to operating in PET BASIC, the command PILOT can then be subsequently used to re enter the interpreter editor system

### Implementing Editor Commands

Having decided upon the direct mode commands to be included a way must be found of recognising valid commands and responding correctly to them and of rejecting other commands with an error message

We shall consider this in some detail since apart from being of importance in its own right it may be thought of as a somewhat *simplified interpreter* accepting commands in the editor language and executing them immediately

The basic idea is to compare the input string with each member of a list of valid commands until either a match is found or else the list is exhausted In the latter case the input was not a valid command so an error message such as ?SYNTAX ERROR is printed and the editor waits for new input. When a valid command is detected the editor program *branches to the appropriate routine* which executes the command including dealing with further syntax such as the optional inclusion of line numbers in a LIST command

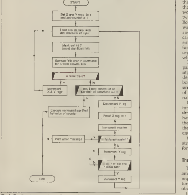

START
Set X and Y regs to 1 and set counter to 1
Load accumulator with Xth character of input
Mask out bit 7 (most significant bit)
Subtract Yth char in command table from accumulator
Is result zero?
Y
N
Increment X & Y regs
Is result zero except for bit 7 set (last char of command word)?
Y
N
Decrement Y reg
Execute command signified by value of counter
Reset X reg to 1
Increment counter
Print error message
Y
Is table exhausted?
N
Increment Y reg
N
Is bit 7 of Yth char in table set?
Y
End
Increment Y reg

Fig 2 Routine to recognize a direct mode command and respond accordingly

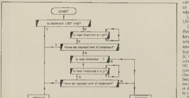

START
Is statement 'LIST' only?
Y
N
Is next character a digit?
Y
N
Y
Have we reached end of statement?
N
Is next character '–'?
N
Is next character a digit?
Y
N
Y
Have we reached end of statement?
N
SYNTAX OK
SYNTAX ERROR

Fig 3 Syntax check for a LIST statement

The list of valid commands is *stored in a table* with some way of specifying the end of one entry and the start of the next One way of doing this would be to use a fixed number of bytes for each entry in the table with padding characters to fill the space for the shorter command words or a zero byte could be put between successive entries in the table Both of these methods are somewhat wasteful of memory and a more compact and neater way of achieving the result can be found This involves storing the entries in the table in true 7 bit ASCII form with the most significant bit off except for the last character of an entry when this bit is set

The search through this table and comparison with individual characters of the input string is best achieved by using independent indexing to search through both the table and the input string Figure 2 illustrates how the X and Y registers of the 6502 chip can be used in combination to carry out this search routine

It should be noted that from the editor's point of view RUN is just another direct mode command even though it has the special effect of causing entry to the interpreter and so it is included in the command table along with the other entries

We now consider an example of the structure of an individual routine for performing a specified editor command

### The List Command

The LIST command is used as an example since it exhibits clearly some of the important general points about the structure of such routines as well as being an obvious facility in any editor

In the case of a LIST instruction there are several different valid forms which it can take For example in MTC PILOT (as in PET BASIC) all of the following possibilities are allowed

LIST LIST 100 LIST 100– LIST 100–200 LIST 200

It is therefore necessary to perform *further analysis* of the string input from the keyboard in order to determine precisely what course of action to adopt. This analysis can be divided into three distinct types –

(i) **lexical** analysis – recognising which characters are letters which are digits etc.

(ii) **syntactical** analysis determining the grammatical structure of the statement including checking its validity

(iii) **semantic** analysis ascertaining the meaning or content of the statement ie what is the appropriate action to perform in order to carry out the statement's intent

These three types of analysis are not in practice clearly separated from one another when implemented but they must

*To page 48* ▶

**BUSINESSMEN**

**Complete Systems supplied to your Business now on reel Computers with a full 12 month warrenty**

| | |
|---|---|
| **Word-Processing** | **from £3950 00** |
| **Integrated Accounts** | **from £3700 00** |
| **Solicitors Accounts** | **from £3700 00** |
| **Insurance/Estate Agents** | **from £3000 00** |
| **Stock Control** | **from £2950 00** |
| **Bespoke Systems** | **P O A** |

Full 64K Superbrains, 320K or 700K, Qume Sprint 5 Daisywheel Printers, Paper Tiger Dot Matrix Printers, Diskettes £20 per 10 Dust Covers £4 00

**For Information Advice Demonstrations and Orders contact**

JAEMMA Ltd

**RELIABLE EQUIPMENT** **RELIABLE SUPPORT**

WEST MIDLANDS
Unit 24 Lee Bank House Holloway Head, Lee Bank Birmingham
**021 747 4531**
EAST MIDLANDS
29 Beachampstead Road Great Staughton Huntington Cambs
**0480 85 262**

MICROCOMPUTER SYSTEMS FOR ALL BUSINESSES

**EMG MICRO SYSTEMS**
**EMG 01-688 0088**

**We are specialists in complete installations tailor made for your business requirements**

| | |
|---|---|
| WORD PROCESSING SYSTEM | £1999 |
| INVOICE AND CUSTOMER SYSTEM | £2999 |
| LEADS AND SALES SYSTEM | £2999 |
| INSURANCE AGENT SYSTEM | £2999 |
| ESTATE AGENCY SYSTEM | £2999 |
| COMPLETE BUSINESS SYSTEM | £3999 |

**We are MAIN LONDON SORCERER STOCKISTS**

Sorcerer Systems Disk Mains Stabilisation Cooling Fan Memory Upgrades Servicing

| | RENTAL |
|---|---|
| Plug-in 315K Disk Drive | **4 31 per week** |
| Video Disk Unit | **5 59 per week** |
| Daisywheel WP System | **14 99 per week** |

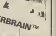
WP Correspondence Course Link your Sorcerer to a mainframe or other Sorcerer

Full software list on request

**6 COPIES OF SOURCE MAGAZINE ONLY £5**

Write to Dept CA2 EMG Microcomputers Ltd
30 Heathfield Road Croydon, Surrey

**SUPERSYSTEMS for MICROBUDGETS with SUPERBRAIN-MICRO and DIGITAL-MINI**



**STEMMOS LTD.**

**SUPERBRAIN™**

**REASONS FOR CONTACTING STEMMOS**

**LOWEST MICRO PRICES**

| | |
|---|---|
| Superbrain 64K | £1940 |
| Superbrain QD | £2335 |
| Compostar Multi users | £3950 |

**FREE**

Professional Advice
System Design
Demo & Quotation

**LOW COST**

Leasing
Maintenance
Software Support

**OTHER FEATURES**

Prompt Delivery
Long Warranty
Leasing

**WIDE RANGE-DOT MATRIX QUALITY PRINTERS-LOW COST**
**WIDE RANGE OF RELIABLE AND WELL TESTED SOFTWARE**

| MICROPRO | |
|---|---|
| Wordstar | £240 |
| With Merge | £290 |
| Mail Merge | £ 70 |
| Data Star | £150 |
| Wordmaster | £150 |
| Supersort | £150 |

| STEMMOS | |
|---|---|
| Programmers Superscreen | £300 |
| Estimation Civil Eng | £500 |
| Travel Agency | £800 |
| Estate Agents | £500 |
| Data Base Information | £300 |
| Job Costing | £300 |

| MICROMAS | |
|---|---|
| Stock Control | £ 300 |
| Purchase Ledger | £ 300 |
| Sales Ledger | £ 300 |
| Nominal Ledger | £ 400 |
| Payroll | £ 300 |
| Full Integrated Pkg | £1150 |

**ENGINEERING**

General Purpose Structural Analysis — Finite Elements

3D Space Frame
Elasto plastic Analysis
Scientific Library

**DEALERS AND SALES AGENT – GOOD DISCOUNT AND COMMISSION**

344 Kensington High Street
London W14

Telephone 01 602 6242 (3 lines)
Telex 893003

ALTOS
The true multi user computer system

**The ALTOS ACS 8000 range of business/scientific micro computers creates a new standard in quality and realiability in high technology micro computers**

### Hard Disk/Multi User Systems

The Winchester hard disk/multi user systems are now available supporting up to 4 simultaneous users and providing a maximum of 58 Megabytes of hard disk data storage

The systems are truly flexible and allow expansion of the ALTOS floppy disk system to keep pace with the users requirements

Still single board features include
- a high speed I/O section with up to six serial ports and one 8 bit Parallel port
- up to 208K of on board R A M
- High speed (4 MHz ) D M A control as standard

Yes mini power and at micro cost too

### Hard Disk Security Back-up

The 17 5 Megabyte funnel tape unit permits selective dumping from the Winchester at a rate of 1 Megabyte per minute

### Built in Reliability

The ACS 8000 range are true single board micro computers making them extremely reliable and maintainable All electronics are socketed for quick replacement Complete diagnostic utility software for drives and memory is provided

The board and Shugart floppy disk drives are easily accessible and can be removed in less than ten minutes

### Quality Software

Unlimited versatility The ACS 8000 range support the widely accepted CP/M and MP/M operating systems plus basic (Microsoft and CBasic) Cobol Pascal and Fortran IV All available now

Logitek in conjunction with its own microsoftware house Interface Software Ltd of Camberley are able to supply a wide range of proven off the-shelf business software including general accounting word processing stock control mailing list etc

There are already over 1000 micro computer installations using this software. A track record which we consider speaks for itself Why re invent the wheel when there is standard software of this quality available now?

### Communication Software

Two new custom software packages are now available for the Altos Computer System operating with CP/M to enable it to communicate with remote machines over ordinary telephone lines ASYNC is an asynchronous package that operates with almost any remote machine SYNCH is a synchronous package for use with the IBM 3780 protocols

### Custom Graphics & Scientific Software

A full graphics and scientific package is now available for use for the Altos with FPP

GRAFLIB is a custom Altos software package containing a complete range of FORTRAN—callable graphics subroutines It is designed with DRE RG—512 board or a Tektronix 4000 series graphics terminal Several multi-colour X Y plotters are supported allowing hard copy in addition to screen graphics.

### After Sales Support

Logitek are supported by DDT Maintenance Ltd who provide a nationwide field maintenance service for Altos products and offer the option of maintenance contracts

### Availability

Logitek carry deep shelf stocks of Altos hardware and compatible peripherals

LOGITEK

**LOGITEK, E.I C Electronics Ltd**
All enquiries to
**8-10 Fazakerley St , Chorley,**
**Lancs. Tel 02572 67615/70206**
also at
**30 Kelvin Ave ,**
**Hillington Industrial Estate,**
**Glasgow G52 4LH**

Logitek are now the exclusive distributors of Altos Computer Products for the U K and Eire

only

....the other computer magazine

**Now on sale at all leading nawsagents or from**
**Business Computing, 4 Valantina Place, London, SE1 (send 75p)**

# BRAND NEWs 15

compiled by Microspy
with Anthony Esgate

This middle section may either be pulled out or photocopied than filed for reference. It will be comprehensive and range over the whole field of products, services, events and courses. **PU** stands for Personal User. **SB** stands for small base – that is small budget or small business. **MB** – medium base, medium budget or medium business. **BB** – big base, big budget or big business. **Addresses** are to be found at the end of **Brand News**.

## Systems

**ABACUS DATA TYPE**
*ABACUS DATA TYPE* exclusive UK distributors for TEI microcomputer range. Range includes two new models 3450 with CRT terminal, keyboard, processor with 800 nanosecond instruction cycle and 64K of 5 MHz memory plus 63700 characters of diskette storage with 6 millisecond track to track seek, from £2450, and 3470 with 5MHz CPU with memory and floppy disk storage of [illegible] million characters from £4200 including Data Type DT2 terminal. Applications software includes financial modelling, investment portfolio, accounting and word processing. *MB*

**COMMODORE**
*COMMODORE VIC 20* full featured expandable colour computer system. Video Interface Chip module. Connects to ordinary television or monitor and provides 5K memory. Features sound, colour, programmable function keys, optional memory expansion to [illegible] Kbytes, PETBASIC, typewriter keyboard, external expansion ports, [illegible] characters by 23 line display, high res [illegible] graphics, graphics character set, [illegible] joystick, paddles, lightpen and external plug in memory and program cartridges. Will be available mid 81 at under [illegible]

**COMPUTER INFORMATION SERVICES LTD**
*COMPUTER INFORMATION SERVICES LTD* WORD MAGIC range of word processors. Basic system offers 24 line display, 64k processor, 2 diskette drives each storing 310000 bytes (155 A4 pages) and a high speed printer [illegible] word processing printer. Price of £6500 includes Magic Wand word processing package, CP/M operating system [illegible] and SCRIPT – a special package for the production of long reports and manuals. Basic compiler included. System can be expanded to 64K of processor memory, 4 [illegible] printers and either a 10 MB Winchester disk drive or up to 4 90MB cartridge disk drives. Can be used as an information storage and retrieval system as well as word processor. *MB*

**COMPUTERMART**
*COMPUTERMART* M 2300 range of microcomputer systems based on Z80 and CP/M operating system. 8" floppy disk drives and 16MB removable, 16MB fixed Winchester hard disk available. Expandable up to 4 by 96 MB on line. Multi processing operating system for a network of terminals each with own processor and memory. Packages available for accounting, wages, stock etc written in CIS COBOL. From £4000. *SB*

**CSC UK LTD**
*CSC UK LTD* MS 4000 Message switching System designed to provide both a message processing and transaction processing capability. Each switch in series uses CSC's software and Tandem Non Stop operating system. Switches support a wide variety of lines and protocols both asynchronous and synchronous. Prime applications are seen as banks, multinational corporations and companies with growing domestic and international traffic. *BB*

**CTL**
*CTL* ICE Intelligent Communications Environment, unique combination of hardware and software which will provide data communications facilities throughout the 80s. Utilises high performance front end microcomputers which are independently programmed using high level communications language. Minimum configuration is self contained unit which mounts directly into DMA port in a Series 8000 host processor. Large system comprises free standing communications processors each supporting up to 64 remote lines via 16 character level processors (CLPs). Standard range of CLPs provide for asynchronous (start stop), synchronous (BSC), SDLC, HDLC and parallel interfaces for connection via modems or direct. First product is CTL 8660 based on Motorola 68B09 microprocessors, offers up to 16 independent front end processors. *BB*

*THE CTL 6680*

**DELPA**
*DELPA TELEXPAD* [illegible] enables handwritten input to be automatically input and translated for machine readable transmission as telex tape. Comprises microprocessor controlled writing area, 40 character [illegible] display and asynchronous [illegible] interface. Inputs translated into standard [illegible] for transmission at between [illegible] baud via standard telephone lines. *MB*

**GEMINI MICROCOMPUTERS**
*GEMINI MICROCOMPUTERS* SYSTEM 801 Z80 based microsystem designed around Pertec FD 250 floppy disk drives and CP/M operating system. Twin 5¼ double sided double density disks provide 630 Kbytes of storage. High resolution graphics. Character set of 128 characters held on disk and loaded into RAM – programmable into Arabic or any other language. 80 by 25 and 40 by 25 screen formats. RS232C serial interface, baud rate software controlled 75-9600. Optional parallel interface. Light pen socket. 50 pin BUS connector and monochrome video output standard. Applications packages available. *SB MB*

*Gemini System 801*

**GRAHAM DORIAN SOFTWARE SYSTEMS LTD**
*GRAHAM DORIAN SOFTWARE SYSTEMS LTD* has formed a new company to market ONYX systems in US and Europe. Onyx system is a Z80 Z8000 based single board computer system combining up to 72 MB of Winchester Technology hard disk, cartridge serial tape backup, 512 Kbytes RAM in low profile desk unit. Can support 1-8 users and utilise CP/M, OASIS or UNIX operating systems. Range of systems are upwards compatible and field upgradable. *MB* Onyx

**HONEYWELL**
*HONEYWELL* DPS 8 70 M Multics version of DPS 8 70 available, also Multics operating system MR8. Configurability and expandability similar to DPS 8 70. Additionally main memory can be expanded from 1 million to 4 million bytes. Basic central system includes system control unit (SCU), 1 MB memory and one 35 slot input-output multiplexer (IOM). Expandable to 6 CPUs, 4 SCUs and up to 4 IOMs. *BB*

**ITT**
*ITT TELEFAX 3250* facsimile transmission system allows copies of up to 30 docu

[illegible]

## LOGITEK

*LOGITEK* [illegible] based on 64K [illegible] Tandem [illegible] RAM and [illegible] MB [illegible] language to [illegible] 20000 [illegible] ledgers [illegible] processing and [illegible] recently [illegible] communications package [illegible] an improved [illegible] operating system [illegible] an applications package for process [illegible] *MB*

## MODATA

*MODATA* distributor for Digital Microsystems computers including DSC 3 single board entry level or networking microcomputer system with 64K RAM [illegible] software selectable single or double density IBM compatible 8 floppy disk drives and DSC-4 with similar drives and minimum 128K RAM to provide multi user multi tasking operation using shared processor with memory map and multibus implementation. Both systems provide CP/M operating system Z80A 4MHz processor 2 8 bit parallel ports and 4 RS232 ports with option to jumper one port to RS422. Hard disk options available in 8 or 14 size for 10 to 55 MB storage capacity. From approx £2500 *SB OEM*

## PERSONAL COMPUTERS LTD

*PERSONAL COMPUTERS LTD* NESTAR network system provides all possible [illegible] distributed processing with all advantages [illegible] Apple microcomputer range. Up to [illegible] Apples linked with microprogram communications by machine language or Pascal callable routines. Central file storage takes available 33 MB of on line storage [illegible] network capable of simultaneous updates [illegible] made available [illegible] private data, common or read only selected [illegible] programs or databases. Apple to Apple communication facilitated by cable between machines accessed by network interface card. Network compatible with all standard Apple peripherals software languages and operating systems. *MB Apple*

## PORTABLE MICROSYSTEMS LTD

*PORTABLE MICROSYSTEMS LTD* DTC 80 microcomputer based on Z80 microcomputer. Supplied with 2K system monitor 8K BASIC in ROM, solid state qwerty keyboard, power supply and case. Enhancements include floppy disks with CP/M, Prestel attachment, full colour graphics, add on RAM, Bus expansion, disassembler in ROM, assembler in ROM [illegible] ROM

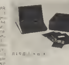
# BRAND NEWs

[illegible]

Enfield Micro [illegible] 80 micro computer

## RAIR

*RAIR* BLACK BOX [illegible] microcomputer system [illegible] range 10 3/20 3/30 3/40 [illegible] 64K bytes of RAM expandable [illegible] disk drive [illegible] ports. Mid range [illegible] disks and built [illegible] Model 3/[illegible] disks. Up to 8 [illegible] connected to a single computer [illegible] storage capacity [illegible] 200 megabyte [illegible] serial I/O [illegible] each model [illegible] a single [illegible] shared [illegible] file resources. BASIC, FORTRAN, [illegible] Pascal and [illegible] From [illegible] *MB Dec*



RAIR [illegible]

## SCICON

*SCICON* Data S[illegible] Terminal Excel [illegible] controlled terminal [illegible] capable [illegible] methods [illegible] Four models [illegible] 400L terminal [illegible]

## SHARP

*SHARP* IQ3100 translator [illegible] English German French Spanish and Japanese. Each section of language contains [illegible] and approx [illegible] language [illegible] simultaneously [illegible] operating [illegible] under memory [illegible] calculator *P*

## SIMACC

*SIMACC* Model [illegible] designed in a modular [illegible] easily programmed [illegible] external peripherals available providing [illegible] mass storage and [illegible] up to 64K memory and [illegible] CPU display [illegible] high level [illegible] generation, word processing [illegible] [illegible] available *MB*

## SOLARTRON

*SOLARTRON* 1090 data management system for dynamic testing application [illegible] on 1170 Series frequency response analyser and Apple microcomputer. Offers a low cost answer to the problem of manipulating and recording dynamic test data *ENGINEERS*

## TEKTRONIX

*TEKTRONIX* 8550 Microcomputer Development Lab offers [illegible] hardware and software resources to accommodate a wide range of approaches to full microcomputer product design. Compatible with existing Tektronix 8002A and 8001 emulators, 8002 is sensible and MDL [illegible] Features include emulation and [illegible] prototype support [illegible] available for [illegible] software [illegible] built [illegible] high level and [illegible] languages *SYSTEMS DEVELOPERS PROGRAMMERS*

# Applications

## ACT APPLEWARE

*ACT APPLEWARE* DESKTOP [illegible] user of Apple II [illegible] range of [illegible] in separate programs. Business [illegible] job costing [illegible] sales forecasting [illegible] preparator [illegible] same spectrum of [illegible] *SB APPLE*

## ADABAS SOFTWARE LTD

*ADABAS SOFTWARE LTD* DATA BASE MACHINE [illegible] commercially available practical backend database system [illegible] loads database management [illegible] from mainframe to plug compatible [illegible] called E[illegible] Support [illegible] (ESP). Adabas DBMS [illegible] multithreaded system which [illegible] relational, hierarchical or network [illegible] date *BB (IBM IBM compatible)*

**C I L. COMPUTER INVESTMENTS LTD**
*COMPUTER INVESTMENTS LTD MARKETING CONTROL SYSTEM* Designed to generate sales leads and build up information files Built on three modules personal and mailing and response control sales activity and reporting and market information and planning and implemented on AM Jacquard equipment Main benefit is aim to allow management to monitor and direct pre sales situations and to relieve sales executive of mundane reporting functions *MB BB (MARKETING)*

**COMMODORE**
*COMMODORE* The Accountant and Paymaster part of the Commodore Management series of programs designed for use on the 8000 series PET Ledgers in former may be personalised using first two digits of account number All functions eq n values posted Statements drawn up etc can be carried out weekly fortnightly or monthly [illegible] data on up to 600 employees in 6 different departments Also [illegible] information system available and [illegible] professional guide's any income l and [illegible] problem in stock control management information etc *SB PET)*

**COMPUTER AUTOMATION**
*COMPUTER AUTOMATION* three new software and documentation packages NM4 Pascal NM4 BCPL and NM4 CORAL 66 for Naked Mini 4 computers *MB OEM*

**DATA RECALL LTD**
*DATA RECALL LTD* series of programs to handle planning applications in local authorities Run on Diamond word and data processing systems Object is to avoid retyping of same information for different purposes *(LOCAL AUTHORITIES DIAMOND)*

**FERRANTI**
*FERRANTI PROCESS MANAGEMENT SYSTEM* PMS process control monitoring and information handling package Applicable to sequence continuous or mixed control processes as well as data acquisition and control requirements Algorithm based and interpretive in operation *(PROCESS CONTROL)*

**HAMILTON RENTALS LTD**
*HAMILTON RENTALS LTD* Weidner Language Translation System Converts one language to another at 24000 words per hour Supplements rather than supplants the human translator enabling him to function as an editor Based on DEC equipment Weidner software is menu driven with driver and multitasker *(TRANSLATORS DEC)*

**HEWLETT PACKARD**
*HEWLETT PACKARD* TDP 3000 Text and Document Processing Software enables HP 3000 Series 30 33 or III computers to carry out text editing and document processing as well as data processing Editing features include adding deleting modifying or rearranging all or parts of a document Formats for letters multi column reports tables form letters and other special documents Mathematical expressions automatic hyphenation subscripts fractions £3 95 each additional copy £1980 Customer support £45 per month Also Model 64810A Pascal 64000 Compiler has been released for Model 64000 Logic Development System Source language is translated directly into relocatable [illegible] then be linked to produce object files £1442 *MB PROGRAMMERS*

# BRAND NEWs

**IBC COMPUTER SYSTEMS LTD**
*IBC COMPUTER SYSTEMS LTD* CPA critical path analysis package to run on 16-bit micro computer system Typical network of 1000 activities takes only 12 minutes to analyse and system will allow up to 32000 activities Complete system including ACT 90 microcomputer dual floppy disk unit VDU printer and software will cost £8500 Features include network analysis resource analysis resource allocation interactive data entry bar chart reports dept and cost work reports key event feature and report resource usage report critical path report least float first start report Written in UCSD Pascal runs on any system supporting it eg Apple II microcomputer *SB MB (UCSD PASCAL)*

**ICL DATASKIL**
*ICL DATASKIL* enhancements to Wordskil package for ICL 7700 Information Processing System WORDSEEK searches over a floppy disk of parts list customer list personnel nominal rolls etc WORDSORT sorts information against a set of parameters or keys WORDSPEL checks words against its dictionary of about 42000 words plus 4000 technical and specialised words WORDSWOP takes output from a TPL (terminal processing language) system and converts it to Wordskil format for further processing (also in reverse for Wordskil output) *BB MB (ICL)*

**LITTLE GENIUS**
*LITTLE GENIUS DEATH* EXPLOSIONS and WORMS First is based on cult game life and involves 2 players trying to dominate screen with their bacteria whilst avoiding randomly generated mutants Second offers 2-10 players chance to dominate screen by series of explosive reactions along unstable rows and columns of grid squares Last involves player moving cursor to create section of worm Winner completely encircles opponents worm £15 each *PU (APPLE)*

**MDS COMPUTER SYSTEMS (UK) LTD**
*MDS COMPUTER SYSTEMS (UK) LTD* COBOL now available on Series 21 range of distributed processing systems Complements MDS's own interactive MOBOL language by providing a batch orientated language more suitable for specific business applications ANSI 74 Level II enhanced with several control functions to increase screen layout flexibility *MB*

**MICROPLAN**
*MICROPLAN* KSAMBO CP/M compatible file management system Designed for both floppy and hard disk based microcomputers Sequential and random access for dynamic file accessing Access times minimised by look aside buffering Space dynamically re allocated Ideal for inventory control library systems client databases mailing lists and personnel records and ledgers Supplied with calling routines for CBASIC and Microsoft compilers *SB MB*

**NCR**
*NCR* IBAS Integrated Business Accounting System Covers financial management accounts nominal ledger bought ledger sales ledger and detailed analysis of sales and purchases Ledgers can be run independently or linked All or parts of package are also available as a bureau service at NCR Data Centres in London Birmingham and Glasgow *MB BB*

**NEWBEAR COMPUTING STORE LTD**
*NEWBEAR COMPUTING STORE LTD* software for the Sharp MZ-80K computer Chess grades 1-5 £10 Cribbage £10 Camelot £7.50 Rea inr £5 Memory Test £5 Disassembler £10 for 20K 36K and 48K machines (can be co-resident with BASIC and ZEN editor assembler *PU (SHARP MZ 80K)*

**PACTEL**
*PACTEL* PACS VS Manufacturing System produced in conjunction with Wang to incorporate interactive capabilities of Wang VS computer Features integrated data base with independent file organisation and multiple key access on line real time editing and validation system recovery capability and full documentation Provides 8 functional modules to support planning and control of manufacturing operations *MANUFACTURING CONTROL (WANG)*

**PANASONIC BUSINESS EQUIPMENT**
*PANASONIC BUSINESS EQUIPMENT* range of software for recently introduced desk top small business computer sales purchase and nominal ledgers payroll stock control invoicing sales statistics and word processing System complete with three ledgers costs about £5000 *MB*

*Panasonic business equipment [illegible] which was introduced last February*

**PLANNING RESEARCH CORPORATION**
*PLANNING RESEARCH CORPORATION* INFOFLO first in a family of application software products integrated interactive financial and management information system comprising 1001 files and 700 programs Arranged in a number of modular subsystems Features are expected to make it particularly attractive to organisations in the manufacturing and distribution fields Maintains these relationships between inventory sales purchasing and production as well as offering multiple warehouse location facility in inventory management module Software to operate on Prime Information System from £8000 *BB (PRIME)*

**RAPID RECALL**
*RAPID RECALL* APPLICATIONS COMPILER for Intel 2920 analogue signal processor designated MCI SPAS-20 Comprises three distinct sections filter design compiler and macro section Engineer can design a filter

b, [illegible] design [illegible] assembly [illegible] programs [illegible] the Z8/Z8 using Intel [illegible] microcomputer [illegible] development system *ENGINEERS*

**SMIS**

*SMIS* (Sheffield Micro Information Systems Ltd) Production Planning Job Costing Systems for microcomputers. Provides enquiries and reports on Job Status and Labour Analysis, exception reporting of jobs and [illegible] session month reports, maintains history file, supports subassemblies and differentiates between estimated and quoted values. Other modules include Capacity Planning, Labour Analysis, Cash Flow Analysis and Job Costing (inc bill of materials) *ME (PRODUCTION PLANNING)*

**THORN EMI**

*THORN EMI* in conjunction with Longman Publishing [illegible] system for learning a foreign language at home on a personal computer. French, German and Spanish available with Italian to follow. Syllabus devised by Louis Alexander. Each course consists of 5 twin track cassettes and learner's manual. Audio material under program control thus synchronised to the text, graphics and interactive material on screen. For use on Atari 400 and 800 personal computer *PU (ATARI)*

**TURNKEY SOFTWARE LTD**

*TURNKEY SOFTWARE LTD* DATA BOSS 32 database management system for DEC VAX 11/780 computers. Developed by Florida Computer Inc, written in FORTRAN IV. Includes data dictionary cataloging, English like Query module and utilities to put applications up quickly. Includes multi level password protection including passwords for schemas and subschema organisations. Also controls how users are to view data *BB (VAX)*

**WESTINGHOUSE MANAGEMENT SYSTEMS**

*WESTINGHOUSE MANAGEMENT SYSTEMS* ABR Automatic Backup and Recovery package for IBM mainframe users. Gives efficient and easy method of managing the space on direct access volumes. Available to users of company's FDR product, which is already in 220 IBM OS installations. ABR's two main functions — incremental backup ie taking tape copies of data sets which habe been changed since last backup run, and archiving or dumping unused data sets on tape to release disk space for more frequently used data *BB (IBM EQUIVALENT)*

## Bureaux, Consultancies, Services, Shops

**AVERY LABEL SYSTEMS LTD**

*AVERY LABEL SYSTEMS LTD* developed what is believed to be one of the most efficient self adhesive price code marking labels yet produced for use at OCR checkouts. Super opaque label incorporating special printer below adhesive which inhibits show through from packaging or contents. Number and quality of labels is controlled by minicomputer. Till prints automatically all information registered by OCR wand *POINT OF SALE*

## BRAND NEWs

**COMPOWER**

*COMPOWER* has installed a [illegible] AP at its Cannock Centre [illegible] creasing CMS services to the [illegible] pany and users of its Powersystem Terminal Service and additional backup. In [illegible] Machine replaces a 4MB 370/158 which will be transferred to service expanding data base systems *BUREAU USERS*

**COMPLETE WORD PROCESSING SERVICES LTD**

*COMPLETE WORD PROCESSING SERVICES LTD* an independent company providing training, recruitment, bureau and consultancy services for the word processing industry *SB MB BB (WP)*

**DATA EFFICIENCY LTD**

*DATA EFFICIENCY LTD* FLIP BOX floppy disk storage units. Made from transparent smoke finish durable acrylic with a hinged lid. Comes complete with index dividers and adjustable tabs. Available in two sizes for floppy disks or mini diskettes, each having capacity for 50–60 disks. From about £22.50 *SB MB*

**DONOGHUE INFORMATION SYSTEMS LTD**

*DONOGHUE INFORMATION SYSTEMS LTD* Tandem Interactive Computer Bureau. Designed around multiple independent processors which are able to guarantee continuous operation even if failure occurs at some point in the system. The failure would be of no consequence to the operator who could just proceed without loss of speed, capacity or flexibility as processors working in tandem (as name suggests) maintained smooth operation *MB*

Tandem [illegible] for [illegible] service offered by Donoghue Information Systems

**DN COMPUTER SERVICES**

*DN COMPUTER SERVICES* Luxo Automatic copy Holder allows operator of VDUs [illegible] not only have the copy they are using at the correct comfortable height and position, but allows them to find the [illegible] moving their hands [illegible] keyboard. Also available is tailor made [illegible] VDU tables, ODE tables and workstations, delivery approx 8 weeks *SB MB BB*

**FISHER-CLARK**

*FISHER CLARK* officially approved by ICL [illegible]

[illegible] *SB* [illegible]

**H H BUSINESS SYSTEMS LTD**

*H H BUSINESS SYSTEMS LTD* [illegible] based three [illegible] service [illegible] purchase of Series 400 microcomputer [illegible] service [illegible] to use at hourly [illegible] chief [illegible] company's West Bromwich head quarters *SB MB*

**IMACS (COMMERCIAL) LTD**

*IMACS (COMMERCIAL) LTD* new [illegible] to computer users enabling them [illegible] analysis of the risk and insurance [illegible] malfunction, abuse or misuse of [illegible] puter installation [illegible] IMACS [illegible] risk secondly recommend physical [illegible] tions and finally offer all [illegible] protection *MB BB*

**INMAC**

*INMAC FORTIFIER* [illegible] and minifloppies. Reinforces [illegible] with tough white mylar ring [illegible] bonded by metal [illegible] driver clamping [illegible] prevents coating [illegible] stops data loss by improper [illegible] out resulting [illegible] magnetic [illegible] cles which [illegible] forced again [illegible] prox 20p per disk [illegible] *MB*

**INTEGREX**

*INTEGREX* PTX40 PET [illegible] Plugs into serial socket [illegible] PAL colour TV [illegible] no power from PET [illegible] memory expansion port on PET. Displays [illegible] full teletext characters [illegible] 96 alphanumeric characters [illegible] graphics characters on 3 by 7 matrix [illegible] and flash and double height [illegible] *PET*

**MICRO C**

*MICRO C* CURRYS has opened three new outlets selling complete [illegible] systems hardware, software [illegible] equipment including Commodore PET, TT 2020, Apple II and Para[illegible] and 8440. In addition [illegible] branded computer Micro [illegible] tured by [illegible] California *PU SB*

**METROTECH MANAGEMENT TECHNOLOGY LTD**

*METROTECH MANAGEMENT TECHNOLOGY LTD* member of Grand Metropolitan Group is now retailing computer games under name Metroplay. Metroplay shops are in [illegible] 15 branches of [illegible] in [illegible] Strand and [illegible] Shops [illegible] also sell Apple range [illegible] personal computer plus [illegible] software *PU SB*

**MOLIMERX LTD**

*MOLIMERX LTD* appointed sole distributors and licensees in UK for [illegible] of Washington DC in conjunction with Acorn Computers and [illegible] ACT sole TRS-80 distributors in UK for Personal Software of the US. Will shortly be introducing VisiCalc for the TRS-80 *PU SB*

# This is what we do..

and we do
it rather well!

Personal Computers Limited

# Why the Sinclair ZX80 is Britain's best selling

# Built: £99.95

Including VAT, post and packing, free course in computing, free mains adaptor

# Kit: £79.95

Including VAT, post and packing, free course in computing

This is the ZX80. A really powerful, full facility computer, matching or surpassing other personal computers at several times the price. Personal Computer World gave it 5 stars for 'excellent value'. Benchmark tests say it's faster than all previous personal computers.

Programmed in BASIC – the world's most popular language – the ZX80 is suitable for beginners and experts alike. And response from enthusiasts has been tremendous – over 20,000 ZX80s have been sold so far!

**Powerful ROM and BASIC interpreter**

The 4K BASIC ROM offers remarkable programming advantages:

- ✻ Unique 'one touch' key word entry: the ZX80 eliminates a great deal of tiresome typing. Key words (RUN, PRINT, LIST, etc.) have their own single-key entry.
- ✻ Unique syntax check. A cursor identifies errors immediately.
- ✻ Excellent string-handling capability – takes up to 26 string variables of any length. All strings can undergo all relational tests (e.g. comparison).
- ✻ Up to 26 single dimension arrays.
- ✻ FOR/NEXT loops nested up to 26.
- ✻ Variable names of any length.
- ✻ BASIC language also handles full Boolean arithmetic, conditional expressions, etc.
- ✻ Randomise function, useful for games and secret codes, as well as more serious applications.
- ✻ Timer under program control.
- ✻ PEEK and POKE enable entry of machine code instructions.
- ✻ High-resolution graphics.
- ✻ Lines of unlimited length.

**Unique RAM**

The ZX80's 1K-BYTE RAM is the equivalent of up to 4K BYTES in a conventional computer – typically storing 100 lines of BASIC.

No other personal computer offers this unique combination of high capability and low price.

*The ZX80 is a family learning aid. Children of 10 years and upwards are quick to understand the principles of computing – and enjoy their personal computer.*

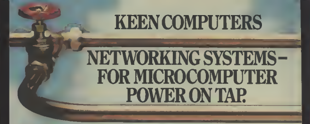
**The Sinclair teach-yourself BASIC manual**

If the specifications of the Sinclair ZX80 mean little to you – don't worry. They're all explained in the specially written 128-page book (free with every ZX80). The book makes learning easy, exciting and enjoyable, and represents a complete course in BASIC programming – from first principles to complex programs.

**Kit or built – it's up to you**

In kit form, the ZX80 is pleasantly easy to assemble, using a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 600 mA at 9V DC nominal unregulated. If not, see the coupon.

Both kit and built versions come complete with all necessary leads to connect to your TV (colour or black and white) and cassette recorder. Plug in and you're ready to go. (Built versions come with mains adaptor.)



# KEEN COMPUTERS

# NETWORKING SYSTEMS – FOR MICROCOMPUTER POWER ON TAP.

## Miracle

**Applications unlimited with database flexibility.**

Add up to 72Mb of Corvus hard disc drive to a single-user microcomputer system – Apple, S-100, Superbrain, LSI-11 and many others – and you're half-way towards a Miracle Add on more microcomputers, link them up with a Constellation shared data multiplexer -- and you've arrived

Miracle puts distributed data processing on tap – with each user station enjoying high speed access and total flexibility A Miracle system can be as big or as small as you want – as and when you want it. With a 4-micro Miracle system you can save £7,000 on a minicomputer system – and gain database flexibility

## Onyx C8000 Series

**Your powerful new ally in applications technology.**

Processor, memory, fixed 8 inch disc and cartridge tape come in a single compact powerhouse – and in two versions.

The powerful 16-bit C8002, which handles up to eight users, has a faster throughput than the PDP-11/45. With its UNIX 7 timesharing operating system, the C8002 gives you the power of a mainframe in a desk-top device Extra user stations and storage capacity can be added in minutes; and C8002s can be connected together in a network.

The 8-bit C8001 is ideal for one or two users and can be easily upgraded to the C8002.

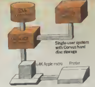
# EXPAND YOUR NET
# NEEDS EXPAND WITH M

## AND YOU CAN START WITH A

## Miracle

A Miracle system has almost unlimited scope for accessing shared data via multiple terminals in accounting, word processing, financial planning, stock control graphics critical path analysis and database management applications – and at the same high speed as with single user systems

In addition to his own dedicated computer and associated memory, each user has access to a central hard disc memory – without interference from other users Miracle also makes it possible for like computers to communicate with each other in the network and for peripherals to be shared


Single-user system with Corvus hard disc storage

**Apple, Alpha, Altos, Superbrain, TRS-80 Models 1 and 11, OEC LSI-11 and all S-100 bus computers**

The system will interface with all these micros – in any combination Traditional peripherals, such as printers and VDUs plus interactive devices like speech output, voice recognition colour graphics light pens and digitisers can also be linked up to give a Miracle system unrivalled configurability

A single-level Miracle network polls up to 8 computers and a two level network allows up to 64 compute

to share the disc memory

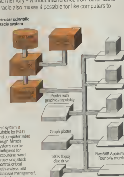
The Constellation shared data multiplexer is used to connect the computers in the system to 10Mb or 18Mb of Corvus hard disc drive Using four disc drives the total capacity of a Miracle system can be extended by up to 72Mb Corvus will work with your existing software and give disc accessing speed which is normally twenty times faster than with floppies

**Mirror back-up system**

The unique Corvus Mirror provides an inexpensive back up for the hard disc system It interfaces the data signals on the disc with a 100Mb capacity video tape system and the entire contents of a 10Mb disc can be archived in about 15 minutes

Making use of a comprehensive range of languages from BASIC COBOL, and FORTRAN to PASCAL ALGOL and APL the applications of Miracle are flexible and almost limitless Cost effectiveness is enormous – for the simple reason you never have to buy more system than you need

Five-user scientific Miracle system



This system is suitable for R&D and computer aided design Miracle systems can be configured for accounting word processing, stock control, critical path analysis and database management applications.

# NETWORK AS YOUR
# TH MIRACLE AND ONYX.

# ITH A SINGLE-USER SYSTEM.

ared
**rain,**

**ters.**
all

nters
like
ur
can

uters

d to
b of

d

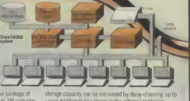
## Onyx C8000 Series

In fields such as computer aided design critical path analysis finite element analysis document production photo typesetting, surveying, cartography and internal electronic mail the Onyx C8002 proves that microcomputer systems have not only caught up with minicomputers – but actually overtaken them!

Take for example the PDP 11/45* – a superb minicomputer system by any reckoning Yet how does it compare with the C8002s compact and cost-effective package of 18Mb of Winchester hard disc drive 12Mb of 3M cartridge tape drive 512Kb of RAM and 16 bit Z8000* processor?

**The plain fact is that all but one of the Z8000's instructions are faster than with the PDP-11/45 – and the C8002 costs a few thousand pounds less.**

Both the C8002 and C8001 can be directly connected to almost any standard terminal printer or modem Disc storage capacity can be increased by daisy chaining up to seven additional disc drives to the internal controller



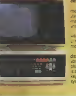
**Eight-user system.**

At the heart of the C8002s advanced systems architecture and powerful throughput is the UNIX 7* timesharing operating system This enables up to eight users to share files (subject to security constraints) and to compile or execute programmes written in BASIC COBOL FORTRAN, UCSD PASCAL, C and MUMPS – concurrently and independently Memory allocation and management uses techniques previously unavailable on microcomputers

When more than eight terminals are required, C8002s can be linked together in a high-speed local network for construction of very large distributed databases – at less than half the price of a comparable minicomputer network

**One or two- user system.**

The 8 bit C8001 available with either OASIS or CP/M* operating systems to tackle similar applications to the C8002 is a powerful one or two user 4MHz Z80A based microcomputer system with 10 or 18Mb 8 inch Winchester hard disc drives (also available for the C8002) and 64Kb of RAM It uses the same cartridge tape drive as the C8002, thus enabling an entire 10Mb disc to be copied in less than 14 minutes It can be quickly upgraded to the C8002 when more computing power or terminals are required



## Ambassador

**User definable terminal provides cost-effective flexibility**

This powerful and flexible terminal implements a major portion of the ANSI X3 64 1979 standard – with a comprehensive set of cursor, erasure editing and transmission commands; and a full complement of graphics

The Ambassador can be customised by selecting the required features downloading command functions setting up operating parameters and defining function key operations.

30 60 line display selectable cursor display and user selectable page window and status areas are available on the 15 inch green phosphor screen. A 94 key detached keyboard is standard including 13 programmable function keys cursor movement and numeric pad and system keys

Zilog is a trademark of Zilog Inc. CP/M is a trademark of Digital Research Inc. UNIX is a trademark of Bell Telephone Laboratories. PDP 11 is a trademark of Digital Equipment Corporation

# KEEN COMPUTERS BRING YOU SERVICE ALL ALONG THE LINE.

**The Keenstar range** of over 200 hardware and software products is backed up by a complete service – from consultancy to after sales

**Consultancy** has been the cornerstone of Keen Computers success They will correctly identify a user's problems and requirements then design, develop and commission a system which exactly fits the bill

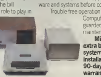
**Software capability** has an important role to play in providing cost effective solutions And this capability has enabled Keen Computers to assemble many of the software packages in the Keenstar range – as well as providing custom-built software as required

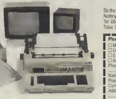
In addition to **staff training,** Keen Computers organise seminars for top management – so that they can fully appreciate a system's potential and derive maximum benefit from it

**Purchase and leasing terms** made available over 5 years through a leading finance company – are supported by full maintenance service Special **short-term hire** facilities are also available for customers who want to appraise equipment or test software and systems before commiting themselves

Trouble-free operation and prolonged life for Keen Computers' installations can be safe guarded with cost effective maintenance agreements

**Microcover Guarantee is that extra bonus for all Miracle/Onyx systems – providing delivery, installation, commissioning and 90-day on-site parts and labour warranty in the quoted price.**





5b the Poultry
Nottingham NG1 2HW
Tel 0602 583254
Telex 37297 (keenco)

Keen Computers

**Please send me details and prices on**

☐ Miracle/Corvus
☐ Onyx C8000 series micros
☐ S 100 ☐ Apple micros
☐ Ambassador VDU

Peripherals (please state) ____________

Please state other services or products in which you are interested ____________

Name ____________
Position ____________
Company/Establishment ____________
Address ____________
Tel ____________

**Please post to Keen Computers 5b the Poultry Nottingham NG1 2HW**
Offices in London and San Francisco

**ENQUIRIES FROM OEMs, DEALERS AND OVERSEAS WELCOME**

# g personal computer.

## Now available for the ZX80... New 16K-BYTE RAM pack

**Massive add-on memory Only £49 95**

The new 16K BYTE RAM pack is a complete module designed to provide you – and your Sinclair ZX80 – with massive add-on memory You can use it for those really long and complex programs – or as a personal database (Yet it can cost as little as half the price of competitive add on memory for other computers )

For example you could write an interactive or conversational program to show people what your ZX80 can do With 16K BYTES of RAM they could be talking to your computer for hours!

Or you can store a mass of data perhaps in a fairly simple program – such as a name and address list or a telephone directory

And by linking a number of separate programs together into one giant, but modular program you can achieve the same effect as loading several programs at once

We're also confident that it won't be long before you can buy cassette based software using the full 16K BYTE RAM So keep an eye on the personal computer magazines and brush up your chess perhaps!

The RAM pack simply plugs into the existing expansion port on the rear of the ZX80 No wires no soldering It's a matter of seconds and you don't need another power supply You can only add one RAM pack to your ZX80 – but with 16K BYTES who could want more!

**How to order**

Demand for the ZX80 exceeds all other personal computers put together! So use the coupon to order today for the earliest possible delivery All orders will be despatched in strict rotation We'll acknowledge each order by return and tell you exactly when your ZX80 will be delivered If you choose not to wait, you can cancel your order immediately and your money will be refunded at once Again of course you may return your ZX80 as received within 14 days for a full refund We want you to be satisfied beyond all doubt – and we have no doubt that you will be

**To Science of Cambridge FREEPOST 7 Cambridge CB2 1YY**

Remember all prices shown include VAT postage and packing No hidden extras Please send me

| Qty | Item | Code | Item price £ | Total £ |
|---|---|---|---|---|
| | Sinclair ZX80 Personal Computer kit(s) Price includes ZX80 BASIC manual excludes mains adaptor | 02 | 79 95 | |
| | Ready assembled Sinclair ZX80 Personal Computer(s) Price includes ZX80 BASIC manual and mains adaptor | 01 | 99 95 | |
| | Mains Adaptor(s) (600 mA at 9V DC nominal unregulated) | 03 | 8 95 | |
| | 16K BYTE RAM pack(s) | 18 | 49 95 | |
| | Sinclair ZX80 Manual(s) (Free manual with every ZX80 kit or ready made computer ) | 06 | 5 00 | |

*NB Your Sinclair ZX80 may qualify as a business expense* **TOTAL £**

I enclose a cheque/postal order payable to Science of Cambridge Ltd for £ ______

Please print

Name Mr/Mrs/Miss ______

Address ______

FREEPOST – no stamp needed CAG02

**sinclair ZX80**

**Science of Cambridge Ltd**
6 Kings Parade Cambridge Cambs
CB2 1SN Tel 0223 311488

# SUN

NOW THE INTEGRAL SYSTEM WITH PERFORMANCE, QUALITY EXPANDABILITY *AND RELIABILITY* ESSENTIAL FOR A BUSINESS SYSTEM

FULL 12 MONTHS WARRANTY

**ABC 24:**— 620K BYTES ON DUAL MINI FLOPPY DISKS

**ABC 26:**— 2 3M BYTES ON DUAL 8 INCH FLOPPY DISKS

**LOOK AT THESE STANDARD AI FEATURES, INCLUDED IN THE PRICE**

**SOFTWARE**

- Dosket Operating System
- Fortran IV
- Utilities
- Diagnostics
- Basic Interpreter/Compiler
- Z80 Assembler
- Library
- Edit (and more)

**HARDWARE**

- 64K Bytes Ram
- Real Time Clock (interval timer)
- Green Screen
- Separate Keyboard
- Security Lock
- Hard Disk available
- Multi User Hard Disk Available soon
- Separate Screen Buffer
- IEEE 488 Interface Bus
- Large Graphics Set
- 2 Full RS232 Ports
- 16 Separate User Definable Keys
- DMA for Hard Disk attachment

**Ai Electronics ABC 24 £3350**

**Ai Electronics ABC 26 £4750**

**OPTIONAL SOFTWARE**

| | |
|---|---|
| * CP/M | £150 |
| * Sales Ledger | £200 |
| * Purchase Ledger | £200 |
| * Nominal Ledger | £200 |
| * Stock Control | £200 |
| * Wages/Salaries | £200 |
| * Above Integrated Packages | £800 |
| * Wordstar and Mailmerge | £350 |
| * ISR Database | £400 |

**ALL WITH SUPPORTING DOCUMENTATION AND LICENSING AGREEMENTS**

**ALL PRICES EXCLUDE VAT**

BY MARCH 31ST 1981 A NATIONAL DEALERSHIP NETWORK WILL BE OPERATIVE FOR THIS POWERFUL MACHINE
IF YOU ARE AN ESTABLISHED AND PROFESSIONAL DEALER WISHING TO APPLY PLEASE CONTACT

SUN Computing Services Ltd
138 Chalmers Way
North Feltham Trading Estate
Feltham
Middlesex
Tel 01 751 5044 TWX 8954428
SUNCOM 6

### MOORE PARAGON

*MOORE PARAGON* self adhesive labels which can be printed on the IBM 3800 laser printer. Special pressure [illegible] which can withstand temperatures of up to 400°F and a pressure of 40 pounds per square inch [illegible] required [illegible] laser printing and have a specially formulated [illegible] adhesive. *BB (IBM 3800)*

### NCR

*NCR* NCR [illegible] microfiche duplicator featuring low power consumption and non-toxic ammonia system. Can produce up to 400 copies per hour, specifically aimed at in-house COM computer output microfilm users. Operated [illegible] rather as office paper copier. Under £6040 *MB BB COM*

### NORPRINT LTD

*NORPRINT LTD* self adhesive computer labels for use on ICL LPS 1 and [illegible] printers. Labels used have [illegible] precise standards. Existing [illegible] special [illegible] colour [illegible] regardless [illegible] sprockets [illegible] pre-printed [illegible] have [illegible] Additional labels have to be trouble free during feeding [illegible] Rectangular [illegible] marks printed on each label using [illegible] purposes. Labels [illegible] backing paper and up to 10,000 [illegible] can be printed. Labels can be produced plain or pre-printed with either peelable or permanent adhesive. *BB (ICL LPS14)*

### PLANNING RESEARCH CORPORATION

*PLANNING RESEARCH CORPORATION* has opened first European customer services centre in Nottingham. Centre is equipped with computer systems worth over £250,000 including large DEC PDP 11/70 and Prime Information System. Company offers a total computer service which includes the [illegible] business automation planning, facility preparation, installation, [illegible] maintenance, programming and running of a computer for [illegible] *BB (DEC PRIME)*

### POINTON YORK

*POINTON YORK* insurance package [illegible] electronics industry essential because of its rapid throughput of products [illegible] loss of profits and also provides [illegible] of up to 30%. Offers [illegible] risks protection for items [illegible] to final destination. Extends [illegible] warehousing and [illegible] including assembly and testing. Premium based on turnover and claims settled [illegible] *ELECTRONICS INDUSTRY*

### RTZ COMPUTER SERVICES LTD

*RTZ COMPUTER SERVICES LTD* FPS80 financial planning, modelling and reporting service based on DEC equipment. Can be used in 2 ways: through RTZ timesharing network and client's existing terminal facilities, or via dedicated machine from micro to mainframe on user's own premises. In latter case FPS80 basic package sells for £10000 with a Hierarchy option at £2000 and a renumber option at £1500. Intended to model selected areas of a company with objective of forecasting key variables, producing reports and performing sensitivity analysis on the assumptions. *MB BB (DEC TIMESHARING)*

# BRAND NEWs

### SIA COMPUTER SERVICES

*SIA COMPUTER SERVICES* [illegible] range of software for project planning and control available on IBM [illegible] JACS is an advanced integrated [illegible] planning and control system developed [illegible] IBM [illegible] providing project [illegible] single [illegible] system [illegible] advanced features [illegible]

### SYSTEM INDUSTRIES

*SYSTEM INDUSTRIES* SITE (System Industries Trade and Exchange) [illegible] designed to meet the requirements of DEC users with surplus user equipment and those [illegible] Company maintains a register of [illegible] Anyone [illegible] included on register [illegible] Haywood SITE Administrator [illegible] Industries *MB BB* [illegible]

### WILKES PCA DATA SUPPLIES LTD

*WILKES PCA DATA SUPPLIES LTD* new company formed to service the computer and word processor supplies market. Will provide a full range of [illegible] paper, bespoke forms and computer room consumables. Fast local service will operate from Online Services in Alperton, Wolverhampton, Newcastle and Warrington with [illegible] centres due to open in 1981. Most consumables will be offered ex stock [illegible] same day dispatch. Also Quickform quick delivery computer form printing service. Provides single or multi part forms for microcomputer or minicomputer or mainframe users in quantities of 1000–3900 *SB MB BB*

### WORDSMITHS

*WORDSMITHS* complete pre print service for computer people handling everything from writing, photography and illustration through typesetting and artwork to the final printed product [illegible] adverts, brochures, catalogues, handbooks, manuals, complete program product documentation. Also specialist typesetting facilities for computer [illegible] such as program listings [illegible] graphic characters and soft/hardware [illegible] handling applications *SB MB BB*

## Exhibitions, Courses, Events

### BRITISH INSTITUTE OF MANAGEMENT

*BRITISH INSTITUTE OF MANAGEMENT* COMPUTER PROGRAMMING FOR MANAGERS series of [illegible] sessions introducing managers to BASIC. 10 Feb, 17 Feb, [illegible] Feb, 3 March 1981 at London [illegible] plus VAT. 4 day course: [illegible] THE COMPUTER MYSTIQUE enables managers to determine what [illegible] likely to need, write [illegible] specifications, use flow charts and write simple programs, negotiate with DP [illegible] and salesmen, discuss [illegible] and understand the [illegible] Strand Palace Hotel £550 plus VAT [illegible] BUSINESS SURVIVAL TECHNIQUES COST EFFECTIVE THINKING 17–18 Feb NUMERATE MARKETING [illegible] 18 March 1981 London Hilton [illegible] plus VAT *MANAGERS*

### BLEASDALE COMPUTER SYSTEMS

*BLEASDALE COMPUTER SYSTEMS* microprocessor courses: DIGITAL ELECTRONICS AND MICROPROCESSORS 5 day workshop [illegible] construction of microprocessor system and how it [illegible] 9–13 Feb 1981 £300 plus VAT. FUNDAMENTALS OF MICROPROCESSORS 5 day workshop describes operation of [illegible] microprocessor and how it is controlled by software 2–6 Feb 1981 [illegible] plus VAT. DESIGNING SYSTEMS WITH MICROPROCESSORS 10 day workshop [illegible] design of a microprocessor [illegible] Feb 1981 £590 plus VAT. HIGH LEVEL LANGUAGE PROGRAMMING 5 day workshop covers high level programming of microprocessors in Pascal [illegible] March 1981 [illegible] plus VAT. MICROPROCESSOR PROJECT MANAGEMENT [illegible] deals with the leadership of [illegible] microprocessor project 23–27 Feb 1981 [illegible] plus VAT *SB MB BB*

### BRITISH STEEL

*BRITISH STEEL* in conjunction with computer education specialists John Matchett Ltd course PROGRAM PLANNING AND DESIGN. Draws heavily on practical experience gained during development of Corporation's massive [illegible] COLTEN telecommunications network. Runs at BSC's residential training centre. Intended to turn programmers with 18 months–2 years experience into program planners. £595 per person plus £145 for accommodation. 9 March, 27 April, 8 June, 21 September, 2 November and [illegible] December. Details from John Matchett *PROGRAMMERS*

### UNIVERSITY OF CHICAGO

*UNIVERSITY OF CHICAGO* seminars DATA PROCESSING OPERATIONS MANAGEMENT London Portman Hotel Feb 23–25 1981 Led by Allan F Froehlich and MINI COMPUTERS AND DISTRIBUTED PROCESSING London Hilton International April 6–8 1981 Led by George R Trimble *MANAGERS*

### CMG COMPUTER MANAGEMENT GROUP LTD

*CMG COMPUTER MANAGEMENT GROUP LTD* free half day seminars to discuss requirements for organisations in computer [illegible] membership record keeping, subscription accounting and mailing. Next to be held on March 4 1981 *MB*

### COMMODORE

*COMMODORE* BASIC FOR BEGINNERS Feb [illegible] ADVANCED PROGRAMMING WITH BASIC March 24 1981 (see Computer Age issue 13 (Dec 80) p 19 for review) *PL SB MB (PET)*

### COMPUTA 81

*COMPUTA 81* 2nd International Computer Technology Exhibition World Trade Centre Singapore [illegible] 24 October 1981. Sponsored by Singapore Computer Society and organised by TF Pte Ltd, a subsidiary of Industrial and Trade Fairs International Ltd. Enables manufacturers of computers and computer peripherals to bring their hardware and software to South East Asia *MB BB*

**COMPUTEX**
*COMPUTEX* Ireland's only pure computer exhibition. Space available now for Computex 81 March 24–27 1981 Leopardstown Exhibition Centre Dublin. Organised by SDL Exhibitions Ltd *MB BB*

**COMPUTING FOR NATIONAL DEVELOPMENT**
*COMPUTING FOR NATIONAL DEVELOPMENT* International Symposium organised by the British Computer Society Developing Countries Specialist Group and sponsored by the Dept of Industry and IBI Rome. Purpose is to support sharing of technology between nations by bringing together experts from around the world to discuss and debate the use of computing in areas of primary activity and natural resources. An attempt will be made to provide delegates with useful information to enable them to access organisations who are able to assist them in national planning for development. The convergence of planners and technologists with policy makers and project engineers offers the opportunity of an original dialogue for this purpose. University of London Institute of Education 20 Bedford Way London WC1H 0AL 23–27 March 1981. Should appeal to policy makers development planners software designers consultants engineers government officials economists and educationalists

**COUCHMEAD**
*COUCHMEAD* COMPUTERMARKETS 81 Scotland Albany Hotel Douglas St Glasgow 17 19 March 1981 North West New Century Hall Corporation St Manchester 24–26 March Midlands Albany Hotel Smallbrook Queensway Birmingham 31 March 2 April London West Centre Hotel Lillie Rd London W6 7 9 April *SB MB BB*

**DESIGN CENTRE**
*DESIGN CENTRE* Design Centre Exhibition 7 Jan 7 March 1981 Will enable the public to see and try out microelectronic products for the home and have a glimpse of the things to come *PU SB MB BB*

**EUROPE SOFTWARE 1981**
*EUROPE SOFTWARE 1981* Megrethall of the Royal Netherlands Industries Fair in Utrecht. Dutch software and computer service industries will show their solutions to commerce and industry which are being forced to rationalise. The visitor will find a wealth of sophisticated computer programs for almost every sort of computer aimed at every specific business and trade 2–4 June 1981 *MB BB*

**HOTEL – CATERING INDUSTRY TRAINING BOARD**
*HOTEL & CATERING INDUSTRY TRAINING BOARD* HOW TO CHOOSE THE RIGHT COMPUTER conference and exhibition Metropole Hotel National Exhibition Centre Birmingham 10–11 March 1981. Concentrates on computers for the hotel & catering industry exclusively from the user's point of view. Fee for exhibition & conference plus refreshments £50 *HOTEL AND CATERING*

**ICS PUBLISHING COMPANY (UK) LTD**
*ICS PUBLISHING COMPANY (UK) LTD* courses COMPUTER AIDED DESIGN AND MANUFACTURING (CAD CAM) Royal Horseguards Hotel London SW1 23–26 Feb 1981. Provides a comprehensive overview of integrated CAD CAM technology as it applies to a wide spectrum of industries. Intended for design manufacturing engineers and managers systems analysts and planners and data processing managers. Also VIO VOICE INPUT AND OUTPUT FOR COMPUTERS ICS PCL Microcomputer Unit Polytechnic of Central London 24–27 February 1981. Designed for product development and design engineers systems analysts programmers and technical managers who will be involved in the planning design and implementation of V10 systems *SB MB BB*

# BRAND NEWs

**INFO 81**
*INFO 81* Cunard International Hotel 10 13 February 1981. Fourth International business computing word processing and information management exhibition plus information management conference. Organised by B E D Exhibitions Ltd *SB MB BB*

**INFOTECH**
*INFOTECH* numerous courses during Feb and March include PROGRAM DESIGN WORKSHOP and SELF OPTIMISING DATABASES *SB MB BB*

**LONDON CHAMBER OF COMMERCE AND INDUSTRY**
*LONDON CHAMBER OF COMMERCE AND INDUSTRY* repeat of practical seminar SHOULD WE BE USING WORD PROCESSING? Purpose of this seminar is to explain what word processing is what it can do and to discuss how it might fit productively into your business. Will also consider future developments in the electronic office including the integration of word and data processing systems developments in electronic mail GPO Prestel and similar innovations 24 Feb 1981 69 Cannon St London EC4N 5AB £23 plus VAT for members £30 non members *MANAGERS (WORD PROCESSING)*

**MELROSE FILM PRODUCTIONS**
*MELROSE FILM PRODUCTIONS* VIDEO BASED TRAINING PACKAGE consists of a video programme and supporting documentation structured to provide a half day course in managing computers. Video programme tells story of a company which embarks on an ambitious computer development. But the company's managers do not understand the process which they have initiated and the outcome is not what they hoped for *MANAGERS*

**MICRO COMPUTER CENTRE**
*MICRO COMPUTER CENTRE* in association with Management Centre Ltd series of one day intensive hands-on instruction courses in the use of Commodore PET based word processing systems initially concentrating on WORDCRAFT but extending treatment to others such as WORDPRO. Held every month from Jan 81. Next dates Feb 11 and March 11 £70 including documentation and refreshments *SB MB (PET WORD PROCESSING)*

**MIDWICH**
*MIDWICH* HANDS ON MICROPROCESSOR WORKSHOPS 5 days held at University of East Anglia. Provides a broad foundation of the skills required for designing and servicing microprocessor equipment. Includes microprocessor and microcomputer system architecture microcomputer programming busses control and synchronisation input output interfacing and interrupt processing structured programming and instrumentation microprocessor development systems interfacing microprocessors to analogue systems £195 plus VAT *PROGRAMMERS ENGINEERS*

**MSS COMPUTER AND BUSINESS CONSULTANCY LTD**
*MSS COMPUTER AND BUSINESS CONSULTANCY LTD* courses held in Worthing during February include MANAGING COMPUTER STAFF 2–4 BASIC SYSTEMS ANALYSIS AND DESIGN 2–6 BASIC FORTRAN 2–6 *SB MB BB*

**NCC**
*NCC* COBOL VIDEO TRAINING PACKAGE will help computer managers overcome the staff shortage by training their own COBOL programmers. Consists of 15 video programmes totalling approx 5 hrs introducing main features of COBOL and guiding student through reading and associated exercises £3925 plus VAT. In addition NCC will be providing training courses in COBOL at its new London training Centre in New Fetter Lane *PROGRAMMERS (COBOL)*

**SOFT 81**
*SOFT 81* series of European software exhibitions and conferences concerned solely with high level software organised by Executive Conferences Ltd in association with a group of independent computer journals. Cunard Hotel 2–4 September 1981. Exhibition will comprise approx 100 systems and applications software houses from throughout the world emphasis being given to IBM conference will concentrate on requirements of particular market in which it is held. For further information ring 01 748 0287 *BB*

**SYSTEMS RELIABILITY LTD**
*SYSTEMS RELIABILITY LTD* repeat of course (2 day) introducing safety and reliability engineers to Fault Tree Analysis due in April. (Fault Tree Analysis is a technique enabling engineers and designers to plot and forecast routes through which minor mishaps escalate into major incidents and to ensure that barriers are built into the system at critical points to prevent the development of major faults) *SAFETY AND RELIABILITY ENGINEERS*

# Literature

**CELDIS**
*CELDIS* new 4th [illegible] be a valuable addition [illegible] electronics engineers [illegible] Divided into 3 sections [illegible] component principals and [illegible] 5 Microsystems principals *ELECTRONIC [illegible] ELECTRICAL BUYERS*

**COMPUTER AUDIT AND CONTROL**
*COMPUTER AUDIT AND CONTROL* INFOTECH state of the art report provides a detailed analysis of the key issues and concerns in ensuring security and reliability in computer systems discusses in detail impact of computer trends on internal and external auditor. New tools and techniques for auditing are examined and assessment given of latest software packages £150 *MANAGERS*

**CONTACT**
*CONTACT* new directory providing unique comprehensive combination of information

vital to those involved with the media [illegible] named personnel [illegible] daily Commerce Government etc From IPC Media Publications [illegible] NPO Offices ERS PRO[illegible]

**CPMUGUK**
*CPMUGUK* [illegible] CP/M Users group JOURNAL Vol 1 No 1 published Nov 80 featured software reviews problem page CP/M tips and features [illegible] £3 [illegible] *SB/LP*

**GOWER**
*GOWER* publishers of [illegible] accountancy sales & marketing and computing including [illegible] titles published by [illegible] 29 eg Robin Bradbeer's The Personal Computer Book REWARDING TOP MANAGEMENT a new publication explaining the principles and practice of pay and benefits for managers earning over £8500 p a Two vols per year £15 *SB MB BB*

**INTERFACE COMPONENTS**
*INTERFACE COMPONENTS* NASCOM MACHINE CODE PROGRAMMING BOOK for Nascom 1 and 2 microcomputers Written by Graham Wilson and intended for novice programmers Takes him step by step through most of the Z80 instruction set 132 pages £4 50 *PI (NASCOM)*

# BRAND NEWs

**MACKINTOSH PUBLICATIONS LTD**
*MACKINTOSH PUBLICATIONS LTD* EUROPEAN ELECTRONIC COMPONENT DISTRIBUTOR DIRECTORY 1980/81 Researched from new by individual questionnaire and telephone follow-up New products include microprocessor development systems bubble memories microwave components hybrid components and ferrites Manufacturer distributor relationship specified 4 language glossary provided An essential reference for component buyers and specifiers who can now source components through 4 countries in one publication *BUYERS SPECIFIERS*

**MSP SOFTWARE PRODUCTS**
*MSP SOFTWARE PRODUCTS* new book The Data Dictionary in Systems Development consists of a general overview of the subject and seven presentations on associated subjects given at DATAMANAGER User Group meetings in terms of dictionary specific references the only dictionary identified is DATA MANAGER 15 dollars from MSP in the USA *MB BB*

**PACTEL**
*PACTEL* MARKET SERIES cumulative experience of hundreds of man years of consultancy in the computer and telecommunications fields UPDATE 80 reports complement and extend original 8 vols total mainframes business communications minicomputers and microcomputers data transmission equipment small business systems and distributed data processing computer terminals and data entry peripherals and memory word processing UPDATE reports analyse 120 product categories within above Concentrates on market appraisal forecast of installed base and shipments product forecasts analysis by country and industry sector technology trends and competitive analysis UPDATE 80 package alone £850 per volume UPDATE plus original Market Series £1400 per volume *BB*

**SYNC**
*SYNC* magazine for Sinclair ZX80 users bimonthly Will carry articles about how best to use the unique features of ZX80 Also applications like financial analysis statistics simulations and games Will also provide reviews of software peripherals and books related to the ZX80 £10 per year *PU (ZX80)*

# Address Bus

for [illegible]

[illegible] 1
[illegible] House
[illegible] Road
[illegible]
[illegible]
[illegible]

[illegible] Ltd
[illegible] House
[illegible] Street
[illegible] 472535

[illegible] Systems Ltd
Link Road
[illegible]
[illegible]
[illegible]
[illegible] 061-480 7020

[illegible] Ltd
[illegible]
[illegible]
[illegible] (0206-30) 2571

[illegible] Ltd
[illegible]
[illegible]
[illegible] 0 031 38611

[illegible] Ltd
[illegible]
[illegible]
[illegible] 01 647 1001

Bleasdale [illegible] Systems Ltd
2 Church Road
Merton Park
London
SW19 1 878 6661

[illegible]
[illegible]
[illegible]
[illegible] 01-[illegible]

British Institute of Management
Foundation
Management House
Parker Street
London
WC2B 5PT 01-405 3456

Celdis
37 Loverock Road
Reading
Berks
RG3 1ED

Lektronic Ltd
Hoddesdon Road
Stanstead Abbotts
Ware
Herts
SG12 8E (0920) 871077

University of Chicago Registrar
c/o Conference Associates
34 Stanford Road
London
W8 5PZ

CMG Ltd
Telford House
14 Tothill Street
London
SW1E 9NE 01 227 3521

Computer Investments Ltd
1 Bentinck Street
London
W1M 5RN 01-486 8911

Commodore Information Centre
360 Euston Road
London
NW1 01 388 5702

Complete Word Processing Services Ltd
106 Rochester Row
London
SW1P 1JP 01-828 9379

Compower Ltd
Headquarters
Cannock
Staffs Cannock 2511

Computer Automation
Hanford House
Denham Way
Maple Cross
Rickmansworth
Herts
WD3 2AD (09237) 71211

Computer Information Services Ltd
225 Seven Sisters Road
London
N4 01-263 4441

Computermart Ltd
Wales Square
60 St Faiths Lane
Norwich
NR1 1NE

Computer Technology Ltd
Eaton Road
Hemel Hempstead
Herts (0442) 3272

Couchmead Ltd
42 Great Windmill Street
London
W1V 7PA 01-437 4187

CSC (UK) Computer Sciences Co Ltd
Heathcoat House
20 Savile Row
London
W1X 1AE 01-437 3043 9

Data Efficiency Ltd
Maxted Road
Maylands Avenue
Hemel Hempstead
Herts
HP2 7LE (0442) 63561

Data General
Hounslow House
724–734 London Road
Hounslow
Middlesex
TW3 1PD 01-572 7455

Data Recall Ltd
Sondes Place
Dorking
Surrey
RH4 3EF (0306) 880617

Data Type Systems Ltd
Unit 23
Elliott Road
West Howe Industrial Estate
Bournemouth
BH11 8JZ (02016) 6561/2

Delpa Systems (UK) Ltd
56 Chiswick High Road
London
W4 1SZ 01-995 8301

Design Council
28 Haymarket
London
SW1 4SU 01-839 8000

Digital Devices Ltd
134 London Road
Southborough
Kent
TN4 0PL (0892) 37877

Digital Equipment Corp (DEC)
Digital House
Kings Road
Reading
Berkshire Reading 583555

D N Computer Services Ltd
West Croft Industrial Estate
Manchester Old Road
Rhodes Middleton
Greater Manchester
M24 4PJ 061-643 0016

Donoghue Information Systems Ltd
Shenstone Drive
Aldridge
Walsall
West Midlands
WS9 8TP (Aldridge) 58855

Ferranti Electronics Ltd
Fields New Road
Chadderton
Oldham
Lancashire
OL9 8NP 061 624 0515

Fisher Clark
Boston
Lincolnshire
PE21 8HZ (0205) 65501

Geest Computer Services Ltd
White House Chambers
Spalding
Lincolnshire
PE11 2AL (0775) 51111

Gemini Microcomputers Ltd
Oakfield Corner
Sycamore Road
Amersham
Bucks (02403) 22307

# BRAND NEWs

[illegible] Eng Co Ltd
[illegible]

[illegible]

[illegible] 1 568 9191

[illegible] Board

[illegible] 802 8886

[illegible] Ltd

[illegible] 616339

IBM
Information [illegible]
PO Box 41
North Harbour [illegible]
Portsmouth
Hampshire [illegible]

[illegible] Data [illegible] Ltd
Reading Bridge House
Reading Bridge Approach
Reading
[illegible]

[illegible]

Amersham
Bucks
HP6 [illegible]

[illegible]

[illegible] (0582) 26848

[illegible] 1 580 4361

[illegible]
EC4N [illegible]

Mackintosh [illegible]
Mackintosh [illegible]
Napier [illegible]
Luton
Beds
LU1 1RG

John Ma[illegible]
10 Alb[illegible]
[illegible]

[illegible]
15

[illegible]

[illegible]

[illegible]
LE[illegible]

NEC
[illegible]
London
[illegible]

[illegible]
[illegible]
Belf[illegible]

[illegible]
London

[illegible]
London
EC2M 4NR

Portable Micro[illegible]
[illegible] House
[illegible]
[illegible]
[illegible]

[illegible] Ltd
[illegible] New Street

[illegible]

[illegible]

Sy[illegible]
Mar[illegible]
24[illegible]
Luton
Bedfordshire

Tektron[illegible]
Beaverton
PO Box [illegible]
[illegible]

[illegible]
HP4 1[illegible]

[illegible]
London
[illegible]

[illegible]nghouse [illegible]
[illegible] High Street
[illegible]
Middlesex

[illegible] 359

We're making you an offer so good that you'll ask:

Where's the catch?

# There isn't one, so read on

Our special offer to you is take out a subscription to either *Computer Age* or *Business Computing* and we'll send you FREE our tape

**'COMPUTERS FOR THE BUSINESSMAN' worth £9**

**THE TAPE:** The biggest obstacle to using a computer in business is the uncertainty and confusion surrounding the subject. Computers For the Businessman goes a long way to giving you a concrete appreciation of the subject. It will help you to talk intelligently to a salesman and enable you to set down your own requirements distinctly and rationally. Once you do that implementation is easy by comparison. Computers For The Businessman is the learning tape you can listen to at home, driving to work or in the office. If computing had a Godfather he would say: This is an offer you cannot refuse.

## Unique in concept—the home computer that grows as you do!

# The Acorn Atom

## £120

plus VAT and p&p

### Special features include

- ✻ FULL SIZED KEYBOARD
- ✻ ASSEMBLER AND BASIC
- ✻ TOP QUALITY MOULDED CASE
- ✻ HIGH RESOLUTION COLOUR GRAPHICS*

* optional

The Acorn Atom is a definitive personal computer. Simple to build, simple to operate. A powerful full facility computer with all the features you would expect.
Just connect the assembled computer to any domestic TV and power source and you are ready to begin. (Power requirement 8V at 800mA). There is an ATOM power unit available – see the coupon below.

**FREE MANUAL**

Free with every ATOM, kit or built, is a computer manual. The first section explains and teaches you BASIC, the language that most personal computers and the ATOM operate in. The instructions are simple and learning quickly becomes a pleasure. You'll soon be writing your own programs. The second section is a reference manual giving a full description of the ATOM's facilities and how to use them. Both sections are fully illustrated with example programs.

**The standard ATOM includes**

HARDWARE

● Full sized QWERTY keyboard ● 6502 Microprocessor ● Rugged injection moulded case ● 2K RAM ● 8K HYPER-ROM ● 23 integrated circuits and sockets ● Audio cassette interface ● UHF TV output ● Full assembly instructions

SOFTWARE

● 32 bit arithmetic (±2 000 000 000) ● High speed execution ● 43 standard/extended BASIC commands ● Variable length strings (up to 256 characters) ● String manipulation functions ● 27 x 32 bit integer variables ● 27 additional arrays ● Random number function ● PUT and GET byte ● WAIT command for timing ● DO UNTIL construction ● Logical operators (AND, OR, EX OR) ● Link to machine – code routines ● PLOT commands DRAW and MOVE

**The ATOM modular concept**

The ATOM has been designed to grow with you. As you build confidence and knowledge you can add more components. For instance the next stage might be to increase the ROM and RAM on the basic ATOM from 8K + 2K to 12K + 12K respectively. This will give you a direct printer drive, floating point mathematics, scientific and trigonometric functions, high resolution graphics.

From there you can expand indefinitely. Acorn have produced an enormous range of compatible PCBs which can be added to your original computer. For instance:

● A module to give red, green and blue colour signals ● Teletext VDU card (for Prestel and Ceefax information) ● An in board connector for a communications loop interface – any number of ATOMs may be linked to each other – or to a master system with mass storage/hard copy facility ● Floppy disk controller and... For details of these and other additions write to the address below.

**ACORN COMPUTER**
4a Market Hill,
CAMBRIDGE CB2 3NJ

Your ACORN ATOM may qualify as a business expense. To order complete the coupon below and post to Acorn Computer for delivery within 28 days. Return as received within 14 days for full money refund if not completely satisfied. **All components are guaranteed with full service/repair facility available.**

Please send me the following items.

| Quantity | Item | Price each inc VAT + p&p | TOTALS |
|---|---|---|---|
| | ATOM KIT – 8K ROM + 2K RAM (MIN) | @ £140.00 | |
| | ATOM ASSEMBLED – 8K ROM + 2K RAM (MIN) | @ £174.50 | |
| | ATOM KIT – 12K ROM + 12K RAM (MAX) | @ £255.00 | |
| | ATOM ASSEMBLED – 12K ROM + 12K RAM (MAX) | @ £289.50 | |
| | 1K RAM SETS | @ £11.22 | |
| | 4K FLOATING POINT ROM (inc. in 12K Version) | @ £23.30 | |
| | PRINTER DRIVE 6522 VIA | @ £10.35 | |
| | (inc. in 12K version) 74LS244 Buffer | @ £5.1 | |
| | MAINS POWER SUPPLY (1.8 amps) | @ £10.21 | |
| | | TOTAL | |

To: Acorn Computer Ltd, 4a Market Hill, CAMBRIDGE CB2 3NJ

I enclose cheque/postal order for £

Please debit my Access/Barclaycard No

Signature

Name (Please print)

Address

Telephone No

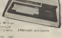
Registered No. 1403810 VAT No. 215 400 220

# Video Genie

## BRITAINS' BEST BUY IN PERSONAL COMPUTERS?

New Model £283 + VAT

–It Only Needs A Plug



- 16K Ram 12K Microsoft Basic in Rom
- TRS-80 Level 1 Compatible
- 100's of Programs Available
- Self Contained Power Supply
- Integral Cassette. Plugs into TV or Monitor
- Ideal for Business, Education + Leisure
- Includes Demo Cassette with 5 Programs, 3 Manuals and Leads

**Options**

Sound Unit fitted when ordering £15 + VAT

Lower Case Chars dealer fitted when ordering £30 + VAT

**VG System Expansion**

| | | | |
|---|---|---|---|
| Expansion Box | £125 | Epson TX-80 Printer | £389 |
| Floppy Tape | £165 | Printer Interface | £ 36 |
| Disc Drive | £225 | S100 Ram Card 16K | £ 86 |
| Sound Synthesiser | £ 55 | S100 Ram Card 32K | £115 |
| Colour Graphics | POA | Monitor 10" B/W Screen | £ 75 |
| Disc Drive only | £145 | Monitor 12" B/W | £ 75 |
| | | Sony 14" Colour TV | £240 |

All + VAT

**Programs**

| | |
|---|---|
| Space Invaders (Cassette with Sound) | £11.00 |
| Othello (Game) Cassette | £ 8.25 |
| Music Master (Cassette) | £14.95 |
| Stock Control | £17.00 |
| Text Edit Word Processor (Cassette) | £15.00 |

All + VAT

**Books**

| | |
|---|---|
| TRS-80 Machine Language from the ground up | £6.95 |
| The Easy Way to Programme [illegible] Book | £5.58 |

**Eprom Erasers**

| | |
|---|---|
| Low Cost Eraser | £35.00 |
| High Speed Eraser | £83.00 |

All + VAT

**Best Memories**

| | |
|---|---|
| 2708 Eproms | £ 3.50 |
| 2716 Eproms | £ 7.45 |
| 2732 Eproms | £13.45 |
| 2532 Eproms | £13.45 |
| 2114 Rams 200ns | £ 2.70 |
| 4116 Rams 200ns | £ 2.85 |

All + VAT

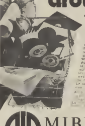
**Q-Tek Systems Ltd**

2 Daltry Close Old Town Stevenage Herts
Tel (0438) 65385

24 hour Despatch
Stock Permitting

# Why shop around...

## ...for all your computer supplies?



[illegible]

**M.I.B.F.**

Barclays Bank Chambers [illegible] Lane Kirkgate Tadcaster
North Yorkshire LS24 9DD
Tel 0937 832868 Telex 55704[illegible]

**Suppliers to Britain's Computer Industry**

# *An APL Microcomputer really makes most sense of all!*

*At no extra cost* you can now purchase an APL Superbrain and have the option of using this most magnificent of all computer languages. All of the standard languages are available too of course so you have absolutely nothing to lose

or you can invest in our own *MAPLE* system *with the option of upgrading to a Z 8000 when the software becomes available*

**APL Superbrain Complete System**
£1895 APL Mnemonics
£2295 True APL Characters

**MAPLE 8"**
**DUAL FLOPPY**
**SYSTEM from £2950**

**Rental and Leasing Terms Available**

**Support:**

- ★ 90 day warranty on all equipment
- ★ Full hardware and software maintenance
- ★ APL conversion service from most standard languages
- ★ On Site consultancy
- ★ APL training courses on advanced APL and APL techniques (in-house or off-site)

**APL Microwriter 120 c.p.s. dot matrix printer £558 + VAT**

Please send for courses brochure for further details • N.B. Prices quoted are correct at time of going to press

APL is in no way an Academic's language its merit lies in the speed that software can be developed – *a factor of 6 over standard languages is not overstating the case!* So often we get enquiries from firms who have purchased a microcomputer and belatedly discovered APL. They ask Can we run APL on our ? ! Be wise whether you use Basic, Fortran, Pascal make sure you have genuine APL capability as well

**APL Applications Software**

Text handling name and address system
report formatting slat-slice database
mainframe communications (IBM DEC )
financial modelling planning
NEW HP Sharp Communications

Alan Pearman Limited

**Tel (0244) 46024**
***or write***
**A P Ltd**
**Freepost**
**Chester CH3 5YZ**

**APL Books**
we stock all APL books in print
Send for our current price list

▶ From page 33

all be present when any form of translation is being performed.

**Figure 3** shows how a statement commencing with the keyword LIST can be checked for correct syntax. The presence of lexical analysis is implicit in the use of the question 'is the next character a digit?' The diagram has been simplified by using 'next character' to mean 'next character which is not a space'.

Semantic analysis is performed as part of the same process as the syntax checking and the results of this analysis determine the details of the way in which the LIST statement is dealt with. For example, in some cases the listing will commence from the first line of source text and in other cases from a specified line number. The routine for executing a LIST statement depending on the results of semantic analysis is illustrated in **Figure 4**.

This pattern of lexical, syntactical and semantic analysis, followed by (or interspersed with) routines to perform the specified actions in different cases, is typical of the way in which direct mode commands are implemented in the editor and also of the way in which the interpreter's routines for executing individual source language statements are constructed.

### Use of Memory

There is one further item to be considered before we get to the point of actually writing any of the implementation software. This is the matter of the *allocation* of the available memory space to be used for various different purposes.

When programming in high-level languages, variable storage is dealt with automatically, but when writing even quite short machine-code programs consideration needs to be given to the question of *what* to put *where* in memory.

The uses for which memory space will be required when the interpreter/editor system is being used can be divided into the following categories –

(i) the computer's overall **operating system** (assumed to be fixed in ROM and not altered by the interpreter writer)

(ii) **operating system variables** (reserved locations in RAM)

(iii) **buffer space** (RAM) – for input from keyboard, communication with cassette unit, disk drive, printer, etc. (location usually fixed by hardware and operating system considerations)

(iv) the **interpreter/editor** software itself (stored either in ROM or RAM)

(v) **current program** (or sections of program) being entered, edited, or interpreted

(vi) **program variable** storage of both simple and array variables – numerical, string, or logical type

(vii) **stack** – for nesting of subroutines, etc. (the stack used by the microprocessor for machine-code subroutine calls, etc. may be used for this purpose, but it may be found more convenient to use a separate stack instead)

(viii) **interpreter** system variables – eg. current line number, pointer to current place in text

(ix) **temporary variables** – eg. value of current expression being evaluated

## Interpreter

The system designer is at liberty to put categories (iv) to (ix) where he likes within the available memory, *but* he should bear in mind the requirement to allow as much room as possible for sections (v) and (vi) – the source program and its associated variables.

### Source Program Storage

Once it has been decided where in memory the source program is to reside, the precise format used for storage must be determined. The format chosen should simplify both editing and interpretation of the source text as far as is consistent with the sparing use of memory.

The method employed in PET BASIC and MTC PILOT is to store the text in *ascending numerical order of line number*, always starting from the same location. The entry for each line contains –

(i) a two-byte **link address** which gives the address of the start of the next line

(ii) the **line number**, stored in two-byte binary form (thus permitting line numbers in the range 0 to 65535)

(iii) the actual **source text** of the line, stored (in MTC PILOT) exactly as entered by the user,

(iv) a zero byte to indicate the **end of the line**.

It is clear why parts (ii) and (iv) must be included, but the presence of the link address requires some comment.

Whilst it is possible to do without link addresses entirely, they are of great utility when it is necessary to *search* through the program for a *given* line number. This situation occurs when a new or amended line of text is typed in, as the editor must find out where to insert it. It also occurs when it is desired to list the program starting from a specified line number. Without link addresses to 'chain' the lines of text together, it would be necessary to scan *all* of the stored text until the desired line was reached.

An additional reason for the inclusion of link addresses is their extreme usefulness to the interpreter when the program

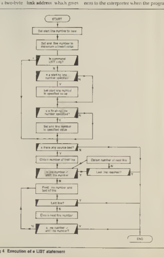

START
Set start line number to zero
Set end line number to maximum allowed value
Is command LIST only?
Y
N
Is a starting line number specified?
N
Y
Set start line number to specified value
Is a finishing line number specified?
N
Y
Set end line number to specified value
Is there any source text?
N
Y
Obtain number of first line
Obtain number of next line
N
Is line number < start line number
Y
Last line reached?
Y
N
Print line number and text of line
Last line?
Y
N
Obtain next line number
N
Is line number > end line number?
Y
END

**Fig 4 Execution of a LIST statement**

is being executed This aspect is dealt with further in the section on interpreter structure

A further technique in the storage of source text should be mentioned Some interpreters such as PET BASIC use single character tokens for command or other standard keywords of the programming language If such tokens are used the editor performs an analysis of each line as it is entered *converting all keywords to tokens* before storing the line in memory This technique can save considerable quantities of memory space since a keyword of say six characters can be stored in a single byte Tokens are not used in MTC PILOT since most commands are single character the longest being three characters (including modifiers)

### Writing the Code

A good place to begin writing the actual code for the implementation software is the section of the editor which waits for accepts and analyses input from the keyboard The correct operation of this section is essential to the functioning of the whole system and it is a fairly straightforward piece of code to write

Having completed this section it is useful to include in the code dummy routines (with no operation' or return from subroutine as their only instructions) for each of the required facilities Doing this will help in gaining some idea of how everything will fit together

The next thing is to get the facilities for entry and editing of source text working After all there wouldn t be much point in writing a LIST routine if there were no way of entering the text to be listed

One can then give one s attention to the routines to perform the various features of the editor The general structure of these routines has been discussed above

This leaves us with the problem of writing the interpreter itself We shall now consider in some detail the interpreter s structure

### Interpreter Structure

We have already remarked that the editor is a simplified form of interpreter In fact, the process for dealing with a single source text statement is entirely similar to that used for dealing with direct mode commands The increased complexity of the interpreter lies in the fact that it has to deal with a sequence of *related* statements rather than with a single statement In this section we discuss how the interpreter s structure allows it to handle this situation

A simplified structural diagram of the MTC PILOT interpreter is shown in **Figure 5**

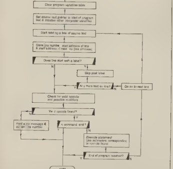

START
Clear program variables table
Set source text pointer to start of program text & initialise other interpreter variables
Start reading a line of source text
Store line number start address of line & start address of next line (line address)
Does line start with a label?
N
Y
Skip past label
Any more text on line?
Y
N
Go on to next line
Check for valid opcode and possible modifiers
Valid opcode found?
N
Y
Print error message & current line number
Is command end?
Y
N
Execute statement
Use subroutine corresponding to opcode found
End of program reached?
Y
N
END

**Fig 5 The structure of the MTC PILOT interpreter**

The source text *pointer* mentioned in Figure 5 is used to keep track of the place in the source text currently being dealt with by the interpreter It is used in much the same way as the microprocesser s program counter is used in the execution of machine code programs In both cases normal program execution with instructions being processed sequentially is achieved by the pointer being successively incremented by one with branching being achieved by setting this pointer to a new value determined by the branch instruction encountered

In the case of an interpreter the initialisation process which takes place after the user has typed RUN but before the source program begins to be executed includes the setting of the source text pointer to a predetermined value the address of the start of program text The pointer then advances through the text byte by byte This progression can be disturbed in three ways –

**#1 a jump instruction or subroutine call** is encountered In this case the source text pointer is set to the start address of the line indicated as the destination of the instruction In the case of a subroutine call the current value of the pointer is also pushed to the stack

**#2 a return from subroutine** instruction is encountered In this case the source text pointer is restored to the value stored on top of the stack and then incremented by one to point to the next byte of program text

**#3 a condition for execution** of the current instruction fails to be met For example if the MTC PILOT statement T(x >y) X is larger' was encountered when x and y had values 2 and 6 then the source text pointer would be immediately set to the start address of the next line of text

The link address stored as the first two bytes of each line is used to facilitate the setting of the source text pointer in case (3) above the source text pointer being set to the value of the link address It is also used in case (1) above as the chaining which results from the presence of link addresses allows rapid searching for a specified label

The line number of each line is stored before the text of that line is dealt with so as to allow simple access to it in case error reporting is required Other system variables needed will depend to a large extent on the particular language being implemented and they will occur to the interpreter writer as he considers the individual commands and the structure of the particular language in detail For example in MTC PILOT system variables are used for storing the number of times the last accept statement has been used in sequence and for flagging whether the last match was successful

Having now covered the main principles of interpreter construction we shall conclude this article There is much more which could be said about the subject – however should you wish to find out more the best way is to try your hand at constructing an interpreter yourself ■

• *MTC PILOT is available in a package consisting of the interpreter a number of sample programs and a manual from Mitac Publishing Ltd Modern Tutorial College Kilburn Lane London W10 4AA for [illegible] pounds + VAT Enquiries on 01 960 5[illegible]*

# A FORTH Commentary

*A full tutorial series on FORTH started [illegible]*

Elsewhere in this issue there is an article by Edward J Murray on an application of FORTH called Chequebook This contains a number of structures with which you might not be familiar (certainly if your only reading has been through my articles) so I thought I would take the opportunity to explain and illustrate some of them

In any programme involving accounting you need to be able to make money entries in conventional format which of course involves expressing the pence as decimal fractions of a pound in two places of decimals There is a structure in FORTH which enables you to use any kind of format you like for numeric strings inserting any characters you want such as decimal points slashes (solidus) etc The structure starts and finishes with a special pair of brackets (delimiters) See 1

```
[illegible]
```

1

This needs to see on the top of the stack a double-precision number You make a stack entry double precision by including a decimal point (no matter where) The number of digits to the right of the decimal point is contained in a location (variable) labelled DPL

I will define a series of examples of the use of these brackets I use the word TRY in each case I generally reserve this word for anything I want to try out See 2

```
[illegible]
[illegible] DOUBLE PRECISION NUMBER [illegible]
```

2

This puts out only the rightmost digit See 3

```
[illegible]
```

3

[illegible] the two rightmost See 4

```
[illegible]
```

4

This puts out all digits

If the number on the stack is required to be negative as for example to indicate a debit balance then the above format won't show it For the structure now see 5

```
[illegible]
```

5

What goes on here is as follows The double number is simply put on top of the stack It is easier to see what is going on if you work in hexadecimal numbers since carry out from low to high word occurs when the low word passes FFFF HEX and the sign of the number in signed arithmetic will occur when the high word goes past 8000 HEX

DABS is a word which returns the absolute value of a double precision number FFFFFFFF DABS will leave a zero on the top of the stack and a one in second place i e the double number 1 whilst SWAP OVER DABS leaves the double number 1 in top and second place and the number FFFF in third place SIGN in example 4 gets this number and if as above, it is more than 8000 it assigns a negative sign to the print out

Since the format of these numbers is handled from the rightmost digit it is easy to print out results in column form with the rightmost digits aligned See 6

```
 TRY <# SWAP OVER DABS # #S SIGN #>
15 OVER - SPACES TYPE
  WE ARE NOW IN DECIMAL

22222222  TRY  [illegible]45874 OK
```

6

This locates the rightmost digit from the end of the word TRY To locate it absolutely on the page you could write TRY CR (for carriage return) but this is awkward since the printout is on the line below The trick for doing this in the proper format for entry of numbers in column is as in 7

```
: TRY SWAP OVER DABS <# #S SIGN #>
CR 1 UP 15 RIGHT 15 OVER - SPACES TYPE

222222222  TRY            [illegible]72745874 OK
1234  TRY                             1234 OK
32651.  TRY                          [illegible] OK
```

7

You can actually do this via a Standard FORTH word which of course is defined in terms of the above constructs The word is D R defined as in 8

```
 D.R >R SWAP OVER DABS <# #S SIGN #>
R> OVER - SPACES TYPE SPACE ;
```

8

The actual number of spaces required must be put on the stack immediately before invoking D R as in 9

```
1234. 15 D.R        1234 OK
```

9

To use the absolute format we write as in 10

```
TRY CR 1 UP 15 RIGHT 15 D.R

1234.  TRY                1234 OK
12.  TRY                    12
```

10

If you should wish to rub out what you

have typed leaving [illegible] the formatted entry define as in 11

```
[illegible]
```

11

If you don't like the OK which appears after every entry end up the definition with QUIT and you won't get it.

Now for more complicated formatting, such as used by Edward J Murray to define the print word $ for placing a decimal point two digits from the end and the word ?CORRECT for ensuring that there will always be just two digits in the right of it to represent in our case the pence. In what follows later the point word to L requires to see a double precision number in which the last two digits are pence to be in keeping with our currency. I am referring to the last definition of Chequebook. See 12

```
[illegible] DATA
   # # 46 HOLD # [illegible]
   [illegible] TYPE SPACE
[illegible]
```

12

The words # # take off the two right most digits 46 HOLD puts out the character whose ASCII Code is 46 namely . (In Murray's version this written ASCII . which must have been defined already) The word ?CORRECT on # SCR 83 makes use of a case statement in a form I am not familiar with. CASE is a defined defining word which creates a data type enabling selection of a number of alternatives. In the way I would use you first define the required actions in each of the alternatives. Presented with 1234 1234 1234 [illegible] 1234 [illegible] CORRECT must pass to L the number 123400 and L will convert this to 1234.00. If more decimal places than two are included the excess is rejected.

When you type a number at the keyboard the position of the decimal point is temporarily stored in a location labelled DPL. If there is no decimal point the variable DPL holds -1. We would then define words as in 13

```
: [illegible]NGLE    ( LE THE POINT   100 M*
    0DECIMAL [illegible]
: 1DECIMAL [illegible]
  2DECIMAL
CASE [illegible] SINGLE [illegible] THAN TOO THAN
          2DECIMAL
      [illegible]
CASEOF ELSE [illegible]
DPL [illegible] REPEAT ENDIF
```

13

CASEOF will select one of the four alternatives according to whether there is a 0 1 2 or 3 on the stack. DPL [illegible] will take care of that.

I will leave the definition of the word CASE for a later issue. For anyone who wants to use Edward J Murray's article but has not a case statement in the dictionary (nor even the necessary word to construct one) the word ?CORRECT may be defined alternately as in 14

```
[illegible]
```

14

The [illegible]

```
[illegible]
```

15

[illegible] the difficult point ■

**Computer Age can sell**
**your product best.**
**Phone**
**Vanessa Blackburn Kiddle**
**01-928 6394**
**for full advertising details**

CODIFIED COMPUTER SYSTEMS

supply *British* Micro computer systems, S100 IEEE cards and peripherals in *London*

Codified Computer Systems 15 Newington Green London N16 Telephone 01 254 7418

WHY A BRITISH MICROCOMPUTER IS ONLY A LONG TERM INVESTMENT

My cousin David has a shop in Rolls Royce and a cash flow problem. His statements are sent out on the 20th of the month and he needs a computer to save a month's bank charges. Such savings would pay for the equipment in less than a year. Adding stock control would enable a second profit to be made.

But David says that I am a poor salesman because instead of promising instant riches on the day after the computer is installed I have imposed conditions on the sale.

The first condition is that David's bookkeeper, who will be responsible for the new computer, will [illegible] his seal of approval on the transaction. The bookkeeper must believe that he will be able to work the computer and control its input and output.

Secondly the business must continue [illegible] while the bookkeeper and his assistant learn [illegible] ware and [illegible]. For this [illegible] David [illegible] the Government to pay [illegible] two school leavers to keep the manual system going until the computer [illegible] bank [illegible] assistant can be relied upon [illegible] but I am [illegible]

With [illegible] hardware [illegible] the USA's cheap why do we recommend that you buy British products? There are several reasons, among them are [illegible] Heathrow [illegible] are not [illegible] in the hope that the [illegible] will make their work and technical [illegible] must be kept as [illegible]

[illegible]

NEW MULTI USE 64k MEMORY

Interactive Data Systems who supply [illegible] have added a 64K Dynamic RAM card and a [illegible] their existing range of S100 and [illegible] consists of a CPU and a single board [illegible] two RS232 [illegible] static RAM and a DSDD floppy disk [illegible]

The 64K card has [illegible] address [illegible] The [illegible] [illegible]

# A FORTH Chequebook Program

This article is intended to show another viewpoint in contrast to that presented by Dr Martin Beer in Issue 8 ("A Pascal Chequebook Program"). It is implicitly a criticism of *conventional* programming languages. Dr Beer must be congratulated on his contribution to algorithmic design and his promotion of structured programming.

## Forth Chequebook

The program and description performs virtually identically to Dr Beer's. Rather than creating my own interaction, I exploit the inherent interactivity of FORTH itself. As a result, the Boolean DONE is superfluous, as is the handling necessary within the routine SUMMARISE.

FORTH is totally and completely interactive, and although an exact replica of the CHEQUEBOOK program is easily written, it is not necessarily desirable.

In FORTH, CHEQUEBOOK could be loaded – that is, brought in and compiled from disk – simply by stating its name CHEQUEBOOK. In addition, CHEQUEBOOK could have been defined in FORTH as

```
81 LOADED-BY CHEQUEBOOK
```

and LOADED-BY could be defined as

```
<BUILDS ( SCREEN -- )
   , DOES> @ LOAD ;
```

I redefine CHEQUEBOOK at the beginning of screen 81 as a dummy

```
CHEQUEBOOK
```

Not only does this prohibit accidental re-loading of CHEQUEBOOK (which would waste memory) but it also gives me a definite point from which I could later FORGET when CHEQUEBOOK is no longer required (i.e. FORGET CHEQUEBOOK). After FORGETting CHEQUEBOOK the previous CHEQUEBOOK is again available.

The current listings have the same inherent problem as Dr Beer's. Namely, the onus is on the user to remember the previous balance. (In FORTH, the previous value can be saved on a screen in a very trivial manner so that executing CHEQUEBOOK initially would automatically recall the previous balance.)

When looking at the screens containing the program, it is noticed that there is not a main program as might be expected in a conventional language. FORTH is totally interactive as well as totally extensible. Therefore, I can do what I want and not what I have to according to some rigid framework arbitrarily demanded by the language.

What I have created is a set of conversational verbs which do what I want when I want. In other words, so long as I have already loaded the program, I can be carrying on with whatever work is necessary. If during this time I write a cheque or receive a payment, I could update my balance and examine the results without stopping what I was doing. Execution of SUMMARIZE does not cause the program to exit as the PASCAL version does. Nor does it have to.

In the same vein, unless I want it, it is not necessary to write a simple editor (C, D, I, R, S and any key, as in the PASCAL) to determine what I am doing. I just do it, and everything is updated in a truly interactive manner.

When looking at the screens of this version (81 through 86), the main interactive verbs used are INITIALBALANCE, SALARY, STOPORDER, CHEQUE, CREDIT, INTEREST and SUMMARIZE. Of course, any other verb in FORTH, either originally supplied or of my own making, can be executed as desired. For instance, if I wish to purchase something which costs R123.46 and I must pay 4% General Sales Tax and I want to write the cheque as well as debit my account, I can say

```
123.46    +4%    2DUP    $
   CHEQUE
```

This will take 123.46, add 4% to it, duplicate it and then print the value (so I know what to put on the cheque) and debit my account. All without having to load anything special or stop what I am doing. Incidentally, I previously defined my own verb +4%, which does pretty much what it sounds like it does.

## Description of Chequebook

In analysing the FORTH screens, I will start at the top (screen 86) and work my way down (top down design).

| SCREEN | DESCRIPTION |
|---|---|
| 86 | Defines SUMMARIZE, and it does just that. |
| 85 | Defines the format statements required by SUMMARIZE. Notice that there is no distinction between FORTH provided verbs and user defined verbs. It is impossible to determine precisely where the system stops and the application begins. |
| 84 | Defines other verbs required by the user in his application: INITIALBALANCE, SALARY, STOPORDER, INTEREST, CHEQUE and CREDIT. If you read the articles on FORTH by Gil Filbey* these will become obvious in their definition. |
| 83 | Takes a number from the keyboard (it is assumed already on the stack due to FORTH's interaction) and ensures that the number, no matter how it got there, is of the correct double precision format. Another point of interest is that the CASE statement does not come with standard FORTH. It is defined in high level FORTH a few screens earlier. This construct is such a part of my personal vocabulary that I load it automatically upon bringing my system up. BEGIN ... IF ... AGAIN is also defined in high level FORTH but is a standard feature (sometimes defined as BEGIN ... WHILE ... REPEAT). |
| 82 | MDIV is a high level FORTH definition which divides a signed double precision number by an unsigned single precision number, leaving a signed double precision quotient. The remainder is discarded (ROT DROP).<br>1+! increments a memory location.<br>D+! takes an arbitrary double precision value on the stack and adds it to a double precision variable in memory.<br>$ does the entire output conversion for the money. |
| 81 | This screen defines single and double precision variables. It is on this screen that I would save the value of the previous balance, hence initialising BALANCE and INITBAL. |

Screen 80 is there for those of us who do not support double precision operations. Screen 87 is a sample program which I could either enter by hand or load from a screen. The fact that nothing on this screen is compiled is normal. The screen is simply an alternative input to the keyboard and compilation/execution modes are normally intertwined. If this concept seems strange to the reader, just remember that FORTH is totally interactive!

87 LOAD produces the sample printout displaying screen 87 and the summary.

## Enhancements for Chequebook

But why stop here? This problem was trivially short to write and debug in FORTH. It took me slightly less than a half hour to produce the enclosed screens and have them completely debugged and running

---

*These have been running in CA from Issue 1.

Consider using an input sequence as follows

123 46 *CHEQUE* 116 *DATED* 1 October 1980
*TO* E J MURRAY *FOR* Computer Programs

The (here italicized) words (CHEQUE DATED TO, and FOR) are defined in high level FORTH using the inherent virtual memory of FORTH I can then not only keep track of the balance but also search the data base according to whatever criteria I desire

Other examples might be

1000 *SALARY FOR* MARCH
300 *SALARY FOR* WIFE S SALARY FOR MARCH
101 13 *CREDIT FOR* RETURNED MERCHANDISE *DATED* 3 MAY
12 13 *INTEREST FOR* BONDS

Of course defining FROM analogously to FOR would make INTEREST read better I underlined all FORTH verbs and could have used upper and/or lower case as desired The fact that SALARY and

## FORTH

FOR appears twice in the same line is of no consequence

With a little imagination and very little effort one could interrogate the data base to list all cheques for April of a certain year or all transactions between certain dates or itemise all cheques made out to a certain party determine which cheques are still outstanding and so forth All interactively and in a very natural manner

### Summary

Why be satisfied with conventional languages? PASCAL might teach structure but it insulates the user from the application while forcing him to remain within a specified structure Rigid structure imprisons a programmer with an imagination

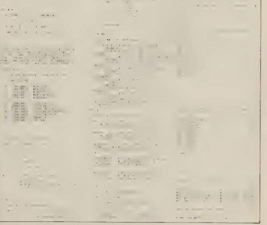
FORTH also saves you memory The entire program as given takes exactly 1140 bytes (decimal) This version of FORTH saves *all* characters in a name and all messages are compiled into memory I could have used virtual memory and kept all messages on disk as well as have chosen smaller names This would have dramatically shortened the size of the program. The enhancements listed above take approximately 150 bytes of memory

### Postscript

For this example, I used an APPLE running Cap n Software s V1 7 This version as well as all versions based on the FIG (FORTH Interest Group) model are more consistent and certainly more powerful than the APPLESOFT version written by Graves

V1 7 is aligned with the International Standards and very closely resembles professional versions of the same language by FORTH Inc ■

*• Edward J Murray is at the University of South Africa P O Box 392 Pretoria 0001 He coordinates FIGSA (Forth Interest Group of Southern Africa) and is the manager of FORTHWITH Computers*



# Unix on Microcomputers

A previous article in *Computer Age* (Issue 13, page 41) described the UNIX* operating system for minicomputers. UNIX like systems for microcomputers have now started appearing and these will be reviewed from time to time as they become available for testing. The impression obtained from the current market place is that where 8 bit micro users are tending to standardise now on either the CP/M or the UCSD operating system, 16-bit machines and larger 8 bit machines are looking to UNIX for a system which offers very powerful facilities but which, because of its design philosophy, can still be implemented with modest effort on a modest configuration. UNIX compatibility also makes available to implementors the wealth of software available on existing UNIX systems. It should perhaps be pointed out that a system will be considered UNIX like only if it includes such features as • pipes, • forking, and • command interpreters on a per user basis, as described in the previous article. The first two UNIX like systems seen as satisfying this condition and available for testing by the author were ONIX for Z8000 systems and OMNIX for Z80 systems.

The original UNIX system is written mostly in the high level language C. This should encourage anyone thinking of putting a UNIX like system up on a different machine to start by writing a C compiler for that machine and to then (subject to licensing arrangements with Bell) bring the system over. Writing a compiler is in general a simpler process than writing a complete general purpose multi tasking operating system. This is what ONYX have done to obtain ONIX, whereas OMNIX is a complete rewrite in a low level language. The effects of this difference in approach are illustrated perfectly by the two systems reviewed below.

## OMNIX

This is a system which runs on large Z80 configurations. It was consciously designed so that CP/M™ software would run under it, to avoid the waste of effort involved in rewriting the large existing body of CP/M software. A less wise decision was to write the system not in C but in a low level language (presumably for reasons of copyright). This has had two major effects, one on the reliability of the system, and the other on its closeness to standard UNIX.

On the reliability aspect, the pre-release version of the software tried by the author was disappointingly fragile. It is to be hoped that later versions will exhibit traditional UNIX robustness, but producing a large error free real time system from scratch in a low level language is an almost impossible task; when will system implementors learn that ordinary users prize reliability and robustness above all other aspects of computer systems?

On the second point, that of being similar to Bell UNIX, the system is, the writers of OMNIX have used the opportunity of a complete rewrite to add a number of extra features to Bell UNIX, mostly taken from the large ICL system GEORGE 3 for 1900 series machines. (To any hardened cynic who says "Can anything good come out of GEORGE 3?", the answer is undoubtedly "Yes!", especially the user features in the command language.) The features added to OMNIX include a number for making the system more suitable for commercial applications.

One example is in easing the user's responsibility for looking after his files while editing.

In GEORGE 3, every edit creates a new copy of the file, and leaves the previous copies intact; you will find, after twenty edits, twenty one copies of the file in your directory, all being charged to your account, and/or overflowing your disc.

In UNIX, the editor works on the file you are editing; to test an amended file (compile and execute it against test data, for example) it must be written back to the file store. Most users write it back over their precious original, and hope that they haven't corrupted it disastrously by mistake. Precautions to keep a back up copy must be taken by the user if he so requires (or the edit command altered, a fairly easy procedure in UNIX).

OMNIX takes a happy medium approach, and keeps a limited number of backup copies automatically.

Another addition aimed at the commercial market is in security by encryption. The system works in full duplex mode, that is to say, all characters are echoed back by the processor as they are typed. To achieve confidentiality, a certain typed character switches off the normal echoing and merely echoes asterisks to the terminal. When a second special character is typed, echoing returns to normal. In the meantime, an encrypted form of the characters being typed has been passed into the system by the terminal handler. This provides a means for making any chosen terminal input (data file name, command name or parameter, directory name, etc) confidential. For example, if this feature is invoked while typing the name of a new file being created, the directory entry will be the encrypted version, including the characters to switch on and off the encryption. Other users may be able to see the encrypted name, but the name can only be regenerated (to access the file in a command) using the same encryption technique. A *very neat* technique, simple to implement and with wide application. The only possible drawback is that it necessitates the input being taken character by character rather than buffered (in UNIX jargon, "raw" mode), which could be an overhead.

A number of really useful extensions is in the "shell" (the command interpreter) of the system. To this have been added a number of the (very powerful) GEORGE 3 facilities which make some aspects of macro writing much easier. Within a command macro in UNIX, the parameters are referred to as "$1" for the first parameter, "$2" for the second, and so on. In OMNIX they can in addition be identified by their leading characters. Thus to call a program "stocktake" which requires three file names as parameters, the user can type either

```
stocktake from old onto new use uplist
```

or

```
stocktake onto new from old use uplist
```

and the parameters are referred to from within the macro as "$(from)" (meaning "the first parameter identified by the letters 'from'"), "$(onto)" and "$(use)". In both of the above calls, the value of "$(from)" is "old" and of "$(onto)" is "new". The order in which the parameters are given in the call of the macro can now be left to the user's convenience, and default values can easily be arranged. This allows the user to omit standard values, all very easily programmed in the macro. There are further facilities to enable the macro writer to test to see whether a certain parameter exists, as in

```
if pr (from)
```

to test whether any parameter starts with the characters "from". (The documentation does not help users by pointing out that "pr" is a mnemonic for "present" and its inverse function "ab" a mnemonic for "absent"!)

A complete OMNIX system from Equinox to support, say, four terminals (assuming that a Z80 can actually handle the processing power they require) requires about 384 kbytes of store and hard disc, at ten to fifteen thousand pounds. The software on its own is very cheap at about 250 pounds, to be compared with the full Bell PDP11 commercial licence at $30 000.

Overall, however, one must be disappointed with OMNIX. Its good features could so easily have been added to standard UNIX, and the many advantages from implementing in a high level language are sadly missed.

## ONIX

ONIX is an example of what the author believes is the correct way to implement UNIX. ONYX (sorry about the spelling confusion, but ONYX as a manufacturer of micro systems existed long before they decided to put up UNIX, and I suppose ONIX was then an obvious name for the software system, bought licence rights for an enormous fee from Bell Laboratories, wrote a C compiler for the Z8000 and then brought up the full official latest Bell release, Version 7. The system is therefore, to a user, identical to the UNIX Version 7 as in use on many PDP11s. In that sense, there is little to say about it since it follows the features described in the previous article very closely. It is really a man-sized system.

---

*UNIX is a trade mark of Bell Laboratories

From the author's initial use of the system, comparing it with PDP11 systems already available, the differences were, as was expected, small. However there appear at present to be two drawbacks: the lack of system source text, and the lack of certain commands.

The licences for PDP11 UNIX, whether at commercial or educational rate, include the full system and its source code.

Experience shows that the availability of the source text has two uses. The first is the obvious one, that it is possible to tailor the system to suit particular needs if the source is available. For example, ONIX as delivered sticks to the UNIX philosophy of friendliness to the user and has no disc space rationing. In spite of (!) our friendly student and staff community, we found it necessary very early on to put a disc space rationing scheme into operation on our PDP11 UNIX, which involved minor modifications to the login command. This is easy if you have the text (and there is a system command du to give the disc usage for the subtree under any specified directory in the filestore) — nigh on impossible otherwise.

The second use of the source is that in general it is the only full and accurate definition of what the exact function of the commands is. The documentation on login merely tells you that it is for logging in, but does not give an exact list of all the accounting functions it performs. Thus the text is really the definitive document on the functions of login. The lack of source text may thus be not too serious a problem for those who already own a Bell licence for UNIX, and therefore know in some detail the function of each part of the system source code; such people could implement the command from scratch in any language. For others it may be a much more serious drawback since undoubtedly one of the major advantages of UNIX is the ease with which it enables the user to tailor the system to whatever he requires of it. It is understood that Keen Computers are looking into arrangements for licencing the system source.

The second drawback is that, for marketing reasons, the system is unbundled and even the C compiler costs extra. This is perhaps acceptable for a first time user who may want the computer for one particular application, and does not want to use the whole system. It was however very frustrating for one who by habit tends to use all of the standard system. The documentation distributed is the standard Bell manual, including all the features of a full system which are not present for reasons of unbundling. This can be frustrating. Perhaps the tidying up of this aspect is one of the duties which Dr Tim Keen of Keen Computers and his merry men will undertake.

On a more favourable note, the minimum system includes a number of the very useful Bell sub-systems for electronic office facilities (electronic mail, diary facilities etc), word processing for text and mathematical applications (all the documentation text is provided on-line) and Computer Assisted Instruction. The last mentioned comes complete with online tuition programs for UNIX and several of its utilities, a great boon for new users. These facilities illustrate perfectly the advantage of standard Bell UNIX!

The power of the Z8000 compared with a Z80 becomes obvious when the software is being hammered. The system can be bought in four or eight user versions with a ten or eighteen megabyte Winchester disc and 512 kbytes of memory, all in a table top box. The cost, including UNIX and C, is in the fifteen thousand pounds bracket. ■

*• Dr Eric Foxley is Senior Lecturer, Mathematics Department, Computing Science Group, the University of Nottingham.*

*Enquiries about OMNIX to Equinox tel 01-739 2387 & 01 729 4460. Enquiries about ONIX to Keen Computers tel 0602 593254 or Graham Joyce tel 0252 874790.*

QUALITY PROGRAMS FOR THE CBM PET

**HOTEL GB** £850 + VAT FOR 32K CBM & CBM DISK

This fast elegant program is the answer to the hotelier's dreams. It makes the billing of guests for their accommodation and services extremely easy. No longer the chore of entering up all the various accommodation charges each night: the computer does it automatically. At the touch of a few keys a guest's account to date can be displayed, and when required, the bill printed with a copy for the hotel.

Daily and period totals to 22 service items, grand totals, payments by cash, payments by 5 different credit cards, deposits, total debtor, the hotel and deleted amounts are always immediately available.

The program also displays the hotel register when required: room numbers and guest names.

This remarkable program has to be seen to be believed: compare it with custom guest billing machines costing three or four times the cost of this program and the necessary hardware, and remember the computer also gives the ability to do the payroll, stock control and general accounting. It is even being used by a 4 star hotel.

**PAYROLL PLUS** £150 + VAT FOR 32K CBM & CBM DISK

This is simply the finest plain paper payroll available for the CBM PET.

Although designed to the Inland Revenue Specifications for Computerised Payroll, it is highly User Friendly and very efficient. Using plain paper avoids the necessity for expensive pre-printing and the annoyance of having to change the paper for various uses.

It covers all Tax Codes, all NI Codes, 3 Overtime Rates, 5 Pre Tax Adjustments, 5 After Tax Adjustments, Hourly, Weekly and Monthly staff, and up to 500 can be mixed on the same file disk.

There are four choices of payroll run method: Payslip print out after each entry. All entries first then a continuous print run. Selected individual employees immediate payslip run without entries. All the payroll is auditable. Analysis into 20 groups. Cash analysis. Etc.

Ask for a demonstration before buying a payroll program: we don't believe you will find an easier payroll to use.

BOTH THESE PROGRAMS ARE NOW AVAILABLE FOR THE 8032 SERIES CBM

*FURTHER INFORMATION AND ADDRESS OF NEAREST DEALER FROM*

LANDSLER SOFTWARE
29A TOLWORTH PARK ROAD
SURBITON, SURREY
01 399 2476 7

**"THIS BOOK IS EXCELLENT"**

– CLIVE SINCLAIR

*This unique book contains 30 programs, all designed to run in the basic 1K version of the Sinclair ZX 80! With this book you will realise that the ZX 80 is more powerful than you ever imagined!*

*112 pages packed with solid information!*

*Programs include BLACKJACK, LINE RENUMBER, MEMORY LEFT, LUNAR LANDER, MASTERMIND, SIMPLE SIMON, PINCH, NOUGHTS AND CROSSES, HORSE RACE, LIFE OR ZX-80 GOMOKU and 19 others!*

*As well as the programs the book illustrates programming techniques you can use in your own programs.*

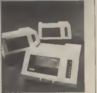
***Available by Mail Order Only £6.95** plus 50p p&p*

***MELBOURNE HOUSE PUBLISHERS***

Orders to: 131 Trafalgar Road, London SE10
Correspondence: Glebe Cottage, Glebe House, Station Road, Cheddington, Leighton Buzzard, Bedfordshire LU7

I enclose £7.45 for each of ____ copies of 30 programs for the Sinclair ZX-80 1K book (Orders outside the UK £7.95)

NAME
ADDRESS
Postcode



# The best connected printers in town!

The Printronix range of dot matrix printers can be interfaced directly to these systems – Burroughs TC500 Datapoint 1100 2200 5500 & 6600, IBM 2780/3780 3270 NCR 8200 IBM 3284, 3286 & 3288 Series 1, System 34 and System 38 Also any other system which will accept Centronics Data Products RS232 or current loop interface

A pretty impressive list of connexions

Printronix printers are extremely versatile They can hold up to 448 characters simultaneously – that's five founts of characters – and they will print anything within a 9 x 9 matrix, including joined or continuous characters

So Arabic and Farsi, for example, present no problems

The Printronix range includes three printers operating at speeds up to 150 300 and 600 lpm respectively The 9 x 9 matrix results in superb print quality Double height characters are standard and there is a very wide range of special characters 6 or 8 lines per inch spacing is interface selectable

All printers employ a simple moving shuttle print mechanism which reduces the number of moving parts and increases reliability All three printers can reproduce bar codes and special OCR characters labels and a variety of logos and symbols can be produced to any size Plot mode produces high quality plotting in up to seven copies

Nearly all the above features can be combined in any machine to meet your exact requirements

Contact us and we'll arrange to demonstrate the best connected printers in town

**pragma limited**

PRAGMA HOUSE
WEIRVALE INDUSTRIAL ESTATE
DENHAM WAY
RICKMANSWORTH HERTS
TEL (09237) 77326

**Information Science** **Knowledge Engineering** **Rob Coe**

# EXPERT SYSTEMS

*An exciting new frontier news of which is just beginning to come through to the general reader*

Ed Feigenbaum one of the pioneers of computer science has been quoted as saying that much of the world is less a mathematical (ie analytical) one and such tractable areas as do exist have already been exploited almost to their limits

It is with ideas like this in mind that some workers in artificial intelligence have been putting forward the notion that many aspects of today s problems could be better catered for by using non algorithmic computing Classical approaches to the computer with its strict determinism and its singular unique paths through problems are simply inadequate to solve the majority of problems met with in the world today International relations for example are far too dynamic and complex to succumb to mathematical deterministic description

One tool that has been put forward on a number of occasions as a possible solution to the dilemma is the expert system developed within artificial intelligence (AI) and proving to be one of the most exciting techniques in the field of computer science

According to Dr Ross Quinlan of the University of Sydney expert systems differ from conventional computer programs in a number of ways Firstly they replace the algorithmic structure with a heuristic one Normally a program written in COBOL or BASIC is such that the process from reading the data to providing the solution is a unique one This process can be followed through on a flow chart say it is totally mechanical and there is no element of chance

The same cannot be said of the expert system with its heuristic methods It employs a process closer to trial and error it contains redundancy there may be more than one way in which the program can achieve a solution Expert systems are based more on the concept of knowledge itself (that is why the subject is sometimes referred to as knowledge engineering)

Knowledge is stored about the task in hand as are heuristic methods, or rules of thumb which guide the use of knowledge towards the solutions of problems in the task domain

Conventional programs are divided into code and data (ie the coded program and the data on which it operates) In a FORTRAN program for example the computer is first fed code on the program and then data But the expert system simply has a body of knowledge and an inference engine According to Quinlan the inference engine 'strikes sparks within the knowledge base and generates the solutions The process is too complex to be gone into here

## Special focus

In general it is thought that expert systems will perform well where •there is a specialised subject domain as in business management or circuit fault finding, say •human experts must perform well there also •performance is more dependent on factual knowledge than on computational procedures •there is an opportunity for incremental development where knowledge about a business can be built up over time •there is opportunity for consultancy sessions as is true of the business world

Probably the best known of expert systems is PROSPECTOR and John Gaschnig from SRI (Stanford Research Institute) in California one of the early workers on PROSPECTOR explained some of its features at a recent conference in London

Gaschnig explained that PROSPECTOR was designed to help in the exploration for valuable minerals an area of application which answers most of the criteria listed above There was •a considerable body of human expertise to be tapped •the problem is not amenable to a solution by algorithmic methods and •there is the possibility of high financial payoff

When PROSPECTOR makes a prediction about the siting of a mineral find the resulting drilling is very expensive but Gaschnig maintains that it has only to make one find and the four years development time will have been paid for

Once the software for PROSPECTOR had been written *consultancy sessions with human experts were arranged so that it could build up its database of knowledge* This said Gaschnig was one of the most expensive parts of the whole project

Once PROSPECTOR has been fed knowledge on the mineralogical problem it can then be fed information on likely sites and it guesses where is the safest place to drill Knowledge in this instance would include statements like porous rocks increase the likelihood of mineral B or porous rocks and glaciation means the likelihood of mineral C These results are grossly over simplified

Although Gaschnig admits that PROSPECTOR has not yet made its big virgin find it has performed very well on the basis of data from established ore fields When fed data from these it has got the siting correct with only a seven percent error

Another successful expert system developed in the US is MYCIN from the University of Stanford It is used by doctors to diagnose bacteriological infections Communicating in ordinary English, it can explain its own conclusions and is able to modify and add to its store of knowledge through interaction with humans A variation of MYCIN is E MYCIN, which is the original stripped of its knowledge and ready for application to *another* problem area American workers try to encourage researchers from Europe to take on these skeleton systems and flesh them out as they wish

One of the oldest and arguably still the best of experts is DENDRAL which is used for recognising molecular spectra DENDRAL takes the results of a mass spectrograph and is able to ascertain which molecular structure gave rise to them Such is its success that Ross Quinlan refers to it as the world expert in terms of time taken and accuracy

Some even say that expert systems could bring about the demise of the Cobol program as it is known now At least this is the belief of one authority on the subject Carl Hewitt an associate professor in the department of artificial intelligence at MIT He has predicted that although the number of Cobol programs written may not decrease in the near future their share of the total effort will tail off steadily

## Productivity

Hewitt suggests that contrary to what most people believe the productivity associated with modern offices is in fact *decreasing* This he says, will put a definite limit on our standard of living, as office activity is showing signs of con suming more work than it actually produces.

According to Hewitt, the reason for this is that conventional computer approaches are entirely unsuited to the structure and working methods of most offices. Conventional computing does not take account of the fact that most commercial organisations *contain subsystems that are in competition with each other*.

The example he gives is of car sales, where the sales department is concentrating all its efforts on getting real sales up. Opposed to this is the accounts received section, who are more concerned with selling only to customers with good credit. They oppose the goal of sales for sales' sake.

So general is this phenomenon that Hewitt maintains it is the reason why it has been so difficult to extend sequential, algorithmically oriented programming languages such as Cobol and PL1 to new office applications. A better approach, he suggests, is to use expert systems.

Hewitt's scheme of knowledge engineering would involve the office expert in subjects like law and accountancy. Humans are better equipped for programming skills and have the knack of extracting information rather than cramming facts as they, against the grain, do now.

It is in the problem solving aspects of modern office work that the expert system will come into its own. Hewitt maintains that, "Problem-solving is a large portion of the office worker's activity. This concept of office procedures differs from the traditional view which sees them as a process that proceeds linearly in time in a step-by-step fashion – this is the viewpoint of all current widely used programming languages."

As a specific example of how an expert system might help, Hewitt considers the case where an office worker has to find the details of a person who had applied to the company for a job in a particular section some while back. The information that the worker has is only very sparse: approximate dates and a rough idea of the person's age. But knowledge based systems are ideally geared to these sort of searches and, judging from the results of their applications in medicine and geology, they should definitely bring useful results.

Adoption of expert systems will also mean that the whole way of running the office will have to change in step. For various reasons the traditional desk will be replaced with a VDU workstation and there will be extensive use of electronic mailing. According to Hewitt, timesharing systems are becoming obsolete. In the not too distant future, each office worker will have his own microcomputer equipped with its own bit map display with a resolution of 1 000 × 1 000. He will have a hardcopy printer capable of producing one page per second and hard disk storage of 300 Mbytes. Archival long-term storage will be achieved on video disks of one gigabyte capacity.

As yet, expert systems have not been focused on business applications as much as their designers might like. Probably the closest they have come is to the educational sector. Of course, their applications there will have ramifications throughout our society, and this includes the business world.

### Education

Education has seen the application of expert systems in the area of Computer Aided Instruction (CAI) and a specialist in this field is Tim O'Shea of the Open University. According to him, the main problem with today's CAI programs is that they are unable to learn from experience. They do not improve on their performance as the human tutor does automatically.

Dr O'Shea also believes that another failing of conventional CAI programs is that they are unable to converse with the student in a natural language. They do not cater for unanticipated responses and they cannot understand the nature of the student's mistakes or misconceptions.

He thinks that the central failing of the programs is the way they handle knowledge and this is where expert systems come in. The way in which knowledge is handled in the educational context may well have a bearing on its handling in business.

> *'contrary to what most people believe, the productivity associated with modern offices is in fact decreasing'*

"In my research," says O'Shea, "the aim was to find a way to express teaching strategies so that it would be possible to prime the system with general and specific hypotheses about alternative ways of teaching. The system should then carry out experiments to test these hypotheses and amend the teaching strategy accordingly."

His own program has been written in LISP and run interactively on the TAURUS timesharing system on a CDC 6600/6400 at the University of Texas. Students using the program were aged between 13 and 15 years and all of them were experiencing difficulties with mathematics.

He claims that, despite the fact that none of the students could cope with quadratic equations before using his tutor, afterwards 74% discovered all the coefficients rules while on line and could solve fairly difficult problems after completing the lesson. He also reports that most of the students enjoyed using the system.

One need not travel to the realms of science fiction to imagine the possibility of using this approach in business. The teacher/pupil interface is one that can be generalised to many aspects of life. For instance, a salesman trying to convince his customer of the benefits of his product is, among other things, faced with an educational task. If computers are to be used in some way to assist in marketing, it is not difficult to see how the techniques of expert systems might be involved. Databases could contain vast amounts of information on a particular market (motorists, say). The program might suggest a particular selling approach, which could be tried out in practice or modelled, and the results fed back to the computer again. In this way the expert systems could assist in the marketing exercise, just as O'Shea's program helps children to learn about maths.

The ethics of such a use of computers is of course a controversial issue. Already a lot of backing for expert systems and general AI research comes from military sources, especially in the US. Like most ethical issues, there are two sides to the coin. Patients who have benefited from the use of expert systems in the diagnosis of their ailments could hardly be in any doubt about the benefit of expert systems.

Most of the work done on expert systems has been on the other side of the Atlantic. Many workers in AI are agreed that a report by Sir James Lighthill to the Science Research Council in 1973 was extremely detrimental to the pursuit of AI research in this country. Lighthill was largely unsympathetic to the cause of AI and a lot of SRC (Science Research Council) funds were discontinued.

Particularly hit was the Machine Intelligence laboratory of Professor Donald Michie at the University of Edinburgh. It is a reflection of the abilities of Professor Michie that he has been able to continue his work and, indeed, lead the world in some aspects.

He has suggested one exciting variation on the DENDRAL theme (see above). He reverses the processes used in DENDRAL and, by associating certain molecular structures with their atomic spectra, he asks the computer to generate possible rules of combination. Nonsensical rules are discarded and sensible rules retained, so that the system bootstraps itself upwards towards increasing performance.

He has also made great efforts to bring the use of expert systems out from the academic cloisters and into industrial applications. Recently he signed a contract with British Petroleum (BP) to use expert systems to diagnose faults on oil drilling rigs. When an oil rig develops a fault, the resulting down time can cost as much as £½m per day. Called ALX, the expert system to be used will be based on hardware similar to the DEC PDP11/34, with 46K bytes of memory.

Developments like this have led Michie to predict that expert systems will soon be available even on personal microcomputers, particularly if the latter are equipped with PASCAL compilers. A whole range of problems unapproachable using algorithmic methods will then line up for solving. ■

■ *Rob Cox is a freelance computer journalist*

# WHAT QUALITY OF JUDGEMENT DO THESE COMPANIES SHARE?

A I D OFFICE PRODUCTS
ACORN COMPUTERS
ACT
API LIMITED
AGA COMPUTER MANAGEMENT
ANGLIA COMPUTER CENTRE

BARCELLOS
BEAM OFFICE EQUIPMENT
BRITISH INSTITUTE OF
MANAGEMENT
BUSINESS & LEISURE
MICROCOMPUTERS
BYTE SHOP COMPUTERLAND

CADDIS COMPUTER SYSTEMS
CENTRALEX
CENTRONICS
CLENLO COMPUTING SYSTEMS
CODIFIED COMPUTER SYSTEMS
COMART
COMMODORE
COMPUTERAMA
COMSERVI
CRANFIELD SCHOOL OF
MANAGEMENT
CREATIVE COMPUTING

DRG BUSINESS MACHINES
DATRON MICRO CENTRE
DISTRICT COMPUTING

EMG MICROCOMPUTERS
EQUINOX

FACIT

GEMSOFT (AFRCO-GEMSOFT)
GENTKE ELECTRONICS
GRAMMA WINTER
GREAT NORTHERN COMPUTER
SERVICES

HB COMPUTERS
HAL COMPUTERS
A J HARDING (MOLIMERX)
HEWIT COMPUTER SYSTEMS
HEYDEN & SON (PUBLISHERS)
HI TECH ELECTRONICS

INTELLIGENT ARTEFACTS
INTERAM
INTERFACE COMPONENTS
INTERFACE SOFTWARE
INTEX DATALOG

JAEMMA
JACOBS COMPUTER SYSTEMS

LB ELECTRONICS
LTT ELECTRONICS
LANDSLER SOFTWARE
LOGIC BOX
LOGITEK
LOGMA

MAP COMPUTERS
MEDIA 5
METROTECH
MICRO BYTE
MICRO CENTRE
MICRO COMPUTATION
MICRO CONTROL
MICRO MARKET
MICROCOMPUTER
APPLICATIONS
MICROBYTE
MICRODATA
MICROLOGIC
MICROPEOPLE
MICRO-PRINT
MICROSOLVE
MICROSTYLE

NASCOM INTERNATIONAL
NATIONAL MICROPROCESSOR &
ELECTRONICS CENTRE
NEWBURY LABORATORIES
NORTHAMBER

PERIPHERAL VISION
PERSONAL COMPUTERS
PETSOFT
PRAGMA

Q-TEK SYSTEMS

RESEARCH MACHINES
RIVER TAY SYSTEM WORKS
ROHAN COMPUTING

S T COMMERCIAL SYSTEMS
SEMEL
SIGMA TECHNICAL PRESS
SIMON COMPUTERS
SCIENCE OF CAMBRIDGE
SINTROM ELECTRONICS
STAGE ONE SOFTWARE
STRUCT
SUN COMPUTING SERVICES
SUPERSOFT
SYSTEMS PLUS
SYCOM COMPUTER SYSTEMS
ENGINEERS

TV JOHNSON
3D
TANGERINE
TRANSAM

VIDEO VECTOR DYNAMICS

WILLIS COMPUTER SUPPLIES

XITAN

ZILOG

They chose *Computer Age* during 1980.

Over the last year the market has changed radically – it has moved away from the hobbyist image and is now highly sophisticated. Are you offering your products and services in the only magazine for the serious user? Are you keeping up with the computer age?

Make the right connection.

Telephone the Advertising Department at 01-928 0394

# Intelligent Scribes

The electromechanical pen plotter has been around for over 20 years with few fundamental changes apart from a switch to direct current servo motors for higher speeds than those provided by incremental stepper motors

Although the electrostatic plotter offers an alternative technology and generally produces diagrams faster pen plotters still have the edge on quality and lower priced entry models – as low as £1,000 compared with around £4 500 for an electrostatic plotter

The market cake is getting larger anyway and most suppliers are finding an expanding market This is a result of dropping prices and wider applications as more modern businesses recognise the importance of research and development in their marketing strategies

Ernie Walman technical computing manager at Perkins Engines anticipates the use of computer graphics growing at a greater rate than the use of computers in general

As a founder member of Eurographics an organisation set up as a counter balance to the US-based Association of Computing Machinery's (ACM) special interest group on graphics Walman estimates an annual growth rate of 60% for the European market for computer aided design (CAD)

Walman said "One of the problems we face in Europe is that apart from Benson most of the equipment manufactured in the US suffers from what I call the dollar mark up", which means that the manufacturer uses the dollar figure and puts a pound sign in front of it

This inhibits the growth of the market However certain companies like Applicon Computervision and Calma are beginning to recognise Europe as a major market

Walman is also chairman of the cad working group of the International Federation for Information Processing (IFIP) and sits on the graphics committees of the British Standards Institution (BSI) and International Standards Organisation (ISO)

He said "We are at the beginning of a boom, but one of the keys to the volume market is when present price barriers on computer aided drafting equipment are broken because the majority of companies are small companies with around 300 employees on their payrolls

He added "Personal computers will also provide a significant market For example an architect or builder can use such systems in house planning

According to a report by Frost and Sullivan the electromechanical plotters market is expected to grow to approximately $366 million by 1986 a compound annual growth of 18% per year

The electromechanical plotter dominates the volume of system output devices sold in the manufacturing industry market The leading supplier is California Computer (Calcomp) who sell as much as all other suppliers combined the report says

*Computer graphics equipment software and services for the manufacturing industries* was published in April 1978 by Frost and Sullivan 104–122 Marylebone Lane London W1

*APPLICON*

Applicon manufacturers its own pen plotters but is essentially a US-based turnkey graphics system company with 20 UK installations

Prices range from about [illegible] for a starter system to £250 000 fully loaded The systems are based on Digital Equipment (DEC) PDP11 34 minicomputers driving Calcomp Versatec or Applicon's own plotters

Both Applicon pen plotters the AGS AP 51 and 53 are of the flatbed type but the company also manufactures the world's first colour ink jet plotter The system can plot up to 17 000 different raster patterns and over 5 000 colours from a print head containing three primary colour ink jets

The AP 51 features interchangeable liquid ink, felt tip or pressurised ball point pens with optional four pen drafting head

The AP 53 features interchangeable line plotter and photoplotter drafting heads It has 144 program selectable alphanumeric and artwork apertures on four interchangeable plates and daylight operation on photosensitive media

*BENSON*

Benson has been established in the UK for over four years and has installed 400 systems

At the bottom end of the range Benson has 15 different plotters varying in width speed and intelligence, from the Model 1101 at £3 500 to Model 1332 at £14 500

The 222 Series is a range of four flatbed plotters using a traditional table type assembly It is priced from £14 500 to £19 000

The 1342 is claimed by Benson to be the fastest plotter in the world with an axial drawing speed of 80 centimetres a second and an acceleration factor of six gravities (6g)

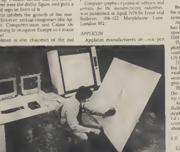
The 5342 is a large cylinder version of the 1342 which takes pre cut sheet sizes up to A0

At the top of Benson's range is the 2532 flatbed plotter for highly accurate scribing applications such as mapping and printed circuit layout to an accuracy of 50 microns on a surface size of a double A0 sheet The system sells for £45 000

*CII*

Computer Instrumentation (CIL) has been established, as the only UK plotter manufacturer for 20 years

The range starts at £2 000 and goes up to around £30 000 for a Series 474 flatbed plotter with magnetic tape unit and in



CALCOMP [illegible] graphics and [illegible] is Calcomp's 960 [illegible] telligent Level II controller

*PYE UNICAM*

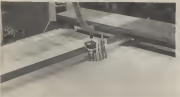
Pye Unicam, a Phillips subsidiary, has just launched the Phillips PM8151 eight pen plotter in the UK and has begun deliveries to some ten customers.

The system is available with either a parallel IEEE488 or serial RS232 interface for £2 700, and options include a 1 Kbyte buffer extension for £125 and a programmable paper tape transport for £334.

*CALCOMP*

Calcomp has approximately 900 plotters installed in the UK, some of which are offline via magnetic tape units and some online, either connected locally or remotely via modems.

According to the company, the trend seems to be to online working, and at last count it had plotters connected online to



*Benson flatbed pen plotter*

84 different systems.

Calcomp has just launched an A3 sized flatbed plotter for £[illegible], the Model 81, with eight programmable pens, single-character commands and internally generated circles, arcs and dashed lines.

Also launched recently is the 960, a four pen plotter with double the area of the earlier two pen Model [illegible]. Both utilise a unique Calcomp belt-bed mechanism which winds paper on a belt, allowing plotting on a flatbed surface. Prices are £25 000 and £17 000 respectively.

Calcomp's general drum plotter range starts at around £4 [illegible] to around £23 [illegible]. The Model 1065, a six-foot wide drum plotter, is claimed by the company to be the widest in the world and sells for over £28 000.

At the top end of the range is the Model 7000, a highspeed flatbed plotter with a drafting area of 46 × 82 inches, prices ranging between £40 000 and £60 000.

*FERRANTI CETEC*

Ferranti Cetec plotters come in two ranges and will link to any 16 bit minicomputer or off line magnetic tape drive via suitable interface.

The company also supplies interactive turnkey graphics systems based on Digital Equipment's Vax 780 range of minicomputers.

# Pen Plotters

At the bottom end, the DT 3454 and 4060 have plotting areas of 34 × 64 inches and 40 × 60 inches respectively, and prices range from £16 000 to £22,000.

At the top end, the Master plotter range provides high accuracy plotting and various options such as a light spot projector for light sensitive film used in printed circuit design, and knives and scribers for printed circuit layout.

The range includes the EP230 general purpose plotter, the EP330 cartographic plotter, and the EP430 printed circuit artwork generator. Prices start at £40 000 to over £50 000.

The company claims to have over 100 installations in the field.

*HOUSTON*

Houston Instruments has the cheapest single pen flatbed plotter on the market, the Hi-plot, with three levels of intelligence, the plotters prices varying from £695 to £885.

It is controlled by BASIC language commands from just about any personal computer through a serial RS232 interface and plots onto A4 sized paper.

Sintrom, Houston's UK distributor, has recently launched Hi-plot's new A3 range, priced from £1 080 to £1,271. The company has sold around 150 Hi-plot A4s.

Sintrom also handles Houston's conventional Complot DP range of drum plotters with paper widths of 11, 22, 36 and 44 inches, priced from £1 800 to £7 915.

It has also just launched Complot's CPS 14 and 15 plotters utilising servo technology and built in intelligent controllers, selling for £6 081 and £7 300 respectively.

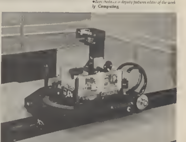
*TEKTRONIX*

Tektronix is essentially a high resolution graphics terminal manufacturer.

The company has two flatbed plotters, the single pen A3-sized Model 4662 selling for £2 989, and the dual pen A2 sized Model 4663 with automatic paper feed and local macro facility selling for £6 336.

Both systems will link to any computer via serial RS232 or parallel IEEE488 interfaces. They have been available in the UK for three and a half years and two years respectively, and Tektronix claims to have over 100 installations. ■

●*Boris Sedacca is deputy features editor of the weekly* **Computing**



[illegible] CAD plotter. Working [illegible] directly on [illegible]

**BYTE SHOP COMPUTERLAND**
your specialist Computerstore.

*Commodore Business System*

Well-proven systems for the serious user. Our computer stores are staffed by business experts, backed by first class maintenance support.

The Commodore is a complete computerized business system, ideal for first time users. Based on the world famous PET computer, it is easy to use and extremely cost-effective. The system includes large capacity disks and an excellent quality printer thus bringing many applications within the reach of the small business.

Find out why the Commodore Business System is so popular – call in to any of our shops for advice and a demonstration of this and other systems.

**London**
48 Tottenham Court Road
London W1P 4TD
Tel 01-636 0647

**Nottingham**
92a Upper Parliament Street
Nottingham NG1 6LF
Tel 0602 40576 Telex 377389

**Manchester**
11 Gateway House
Piccadilly Station Approach
Manchester
Tel 061 236 4737 Telex 666165

**Birmingham**
94-96 Hurst Street
Birmingham B5 4TD
Tel 021 622 7149 Telex 339186

**Glasgow**
Magnet House
Waterloo Street
Glasgow Tel 041 221 7409
Telex 779263

**BYTE SHOP COMPUTERLAND**
– your specialist Computerstore

**BEAVER SYSTEMS**

Norlett House
Dormer Road
Thame
Oxon OX9 3UC
Telephone Thame
(084421) 5020 (24 hr)

## YOUR COMPLETE
## OHIO SCIENTIFIC SERVICE

**HERE ARE FIVE VERY GOOD REASONS FOR CALLING US –**

1. **O S I SYSTEMS**
   including the popular SUPERBOARD II and CHALLENGER 4P as either cassette or disc based systems
2. **O S I SOFTWARE**
   Cassette and disk based software covering a broad spectrum of uses. Some of the cassette based software can also be used on the U K 101
3. **BEAVER SOFTWARE**
   Business, educational and entertainment software ... professional programs with full listings and documentation. Also available for other systems ... especially the U K 101
4. **BEAVER PROGRAMMING AIDS**
   including Video Workpads, BASIC workpads, Machine code Workpads, Cassette Index cards and labels and Blank cassettes, all available for OSI, U K 101 and TRS-80
5. **BEAVER EXPANSION**
   Economy memory expansion using motherboard and slot in 8K RAM boards, 8K EPROM boards, floppy control board & shortly PROM Programmer board. Buy as much as you need when you need it

**CALL OR WRITE . . NOW!**

**MicroStyle**

9 St. Peters Terrace
Lower Bristol Rd
Bath BA2 3BT
Telex 44371 (KEMP G)

**PETS**

| | |
|---|---|
| 8K | £415 |
| 16K | £525 |
| 32K | £650 |
| 8032 | £895 |

**DISC DRIVES**

COMPU/THINK

| | |
|---|---|
| 400K | £795 |
| 800K | £995 |

**PRINTERS**

| | |
|---|---|
| EPSON TX80B | £359 |
| EPSON MX80 | £425 |
| TCM 100 (40 col) | £240 |
| TCM 200 (80 col) | £359 |
| ANADEX DP8000 | £485 |
| ANADEX DP9500 | £895 |
| ANADEX DP9501 | £995 |
| PAPER TIGER | £585 |
| BASE 2 | £395 |

**VIDEO MONITORS**

| | |
|---|---|
| 10 BLACK & WHITE | £85 |
| 10 GREEN SCREEN | £95 |

| | |
|---|---|
| OHIO C1 P | £220 |
| OHIO C1 E | £255 |
| SUPERBOARD | £160 |
| SUPERBOARD 'E | £195 |
| VIDEO GENIE | £330 |
| SHARP MZ80K | £480 |
| APPLE II | £695 |

**SUPERBRAIN**

Superbrain's CP/M operating system boasts an overwhelming amount of available software in BASIC, FORTRAN, COBOL and APL. Whatever your application, General Ledger, Accounts Receivable, Payroll, Inventory or Word Processing, Superbrain is tops in its class.

320K £1850 700K £2400
1.5 £2750

PLEASE ADD 15% VAT ON ALL PRICES

**TEL: BATH (0225) 334659**
**AFTER HOURS (0761) 33283**

# Computers In General Practice

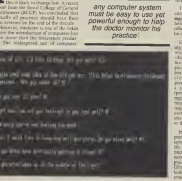
*The author gives a general outline of the micro as an aid to the GP The inset panel gives some details of MICKIE the medical interviewer developed at the NPL by the late Dr Christopher Evans which is a system dealt in by the author's company*

Today few general practitioners have their own computer systems — but this is likely to change fast A recent report from the Royal College of General Practitioners (RCGP) has concluded that virtually all practices should have their own systems by the end of the decade

However, medicine is one of the fields where the introduction of computers has been *slower* than the forecasters predicted The widespread use of computer based diagnosis and full medical r[illegible] seems little nearer today than it did [illegible] years ago On the other hand the [illegible] in favour of more limited computer [illegible] tems in general practice are now [illegible] strong

General Practitioners operate as independent contractors to the health ser[illegible] Thus they are free to spend their own [illegible] as they see fit without first hav[illegible] the bureaucratic hurdles put in the [illegible] of their hospital colleagues Th[illegible] of this independence is that [illegible] ment in computing will probably have to be met out of their own pocket Only the optimists believe that the DHSS will reimburse GPs for the cost of installing computers but these costs [illegible] of course be off set against income tax

> any computer system must be easy to use yet powerful enough to help the doctor monitor his practice'



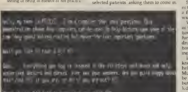
The backbone of any general practice computer system must be the **patient register** This provides the essential patient identification information needed by other applications and will be found to be cost effective *in its own right*

General practitioners are paid according to a complex schedule designed to reward them according to their responsibilities workload experience and practice expenses The largest part of this package is a capitation fee for each registered patient with higher rates for those over 65 and over 75 Manual registration procedures are seldom very efficient and a significant number of new patients (perhaps one in twenty) may never be registered properly with the Family Practitioner Committee Tightening up the registration procedures and claims for items of service can substantially increase income and contribute towards the cost of the computer

Improved business efficiency is important but doctors are concerned principally with the efficiency and quality of the care they provide Each general practitioner has on average some 2 200 patients and most now work in group practices, typically of 12 000 patients GPs are responsible for and are paid to look after all their patients — yet their attention is inevitably focussed on those who actually come to surgery

The conventional medical record the "Lloyd George" envelope introduced in 1920 is of no help in identifying at risk patients who stay at home Manual registers such as age sex registers and disease registers have been developed but these have never proved very satisfactory The RCGP report mentioned earlier states

> The inescapable conclusion is that no available manual system is cost effective in the sense that cost is seen as a doctor's input of energy and the effectiveness as his feeling of being in control of his practice



This gives a definition of cost and effectiveness which is well worth pondering Any computer system must be easy to use yet powerful enough to help the doctor monitoring his practice He wants to be able to identify all girls between 10 and 13 for immunisation against German Measles all patients with chronic lung disease for a vaccination programme against influenza and to be reminded of which patients have diabetes are allergic to penicillin or have been fitted with an IUD

A typical computer based patient register is now outlined It consists of a fixed length record for each patient 126 bytes long containing patient identification details registration details and medical and social factors This system has 64 one bit flags (eight bytes in all) which indicate ("signal") the presence or absence of classes of problems or risk factors These are selected by the practice itself and can cover a wide range of characteristics relating to medical history long term drug therapy family and social problems

Extremely flexible analysis programs are provided The practice can list its patients in alphabetical order in age order or grouped by postcode Patients may be selected according to doctor FPC areas patient area age group or any combination of characteristics or flags This provides a new tool enabling the practice to introduce effective community and preventive medicine Medical time bombs ticking quietly away can be found and defused before they go off saving untold human suffering

Office efficiency can be improved by using the register to print sticky labels for all sorts of forms and for specimens to be sent for laboratory analysis Standard letters can be prepared automatically for selected patients asking them to come in for routine inoculations and screening tests (e g cervical smears) A word processing facility simplifies the task of writing referral letters to hospitals

The cost of such a system depends primarily on the size of the practice

- A practice with less than 6 000 patients would be quite happy with a system based on a dual 8 inch floppy disk drive
- A single full size double density double sided disc can accommodate nearly 8 000 records but for more than about 6 000 a hard disc is highly desirable

Such systems are now being marketed as turn key systems from about £6 000 for a floppy disc system to £9,000 and upwards for hard discs

We have described the patient register as the backbone of any practice information system but there are many other functions such as computer interviewing drug prescribing and computer information systems which will be found increasingly at your local surgery

In general, the more your doctor knows about you the easier he finds it to help effectively with your problems Much of what the practitioner does may be described as providing reassurance but this can only be done in the knowledge of the patient's family and social circumstances and past medical history This is one reason why the older family doctor is generally preferred to the bright young locum or trainee straight from medical school It can take years for a doctor to get to know you properly and most of the information is kept in his head rather than in the notes The notes are frequently incomprehensible even to the writer let alone to his partners or to locums

Drug prescribing is another area where the computer can save time and effort and also lead to improved medical care particularly for repeat prescriptions Handwriting on prescriptions is notoriously bad and the neat computer printed prescription may save clerical time and

*'the more your doctor knows about you the easier he finds it to help effectively with your problems.'*

### MICKIE FROM ABIES

MICKIE is a medical interviewing computer system MICKIE was the brain child of Dr Christopher Evans (of the "Mighty Micro") who was responsible for its development at the National Physical Laboratory from its earliest inception around 1970 until his tragic death in 1979 MICKIE involves direct patient computer dialogue Patients sit at a simple VDU type terminal and use a simple key pad with YES NO and ? responses The patient is led through a carefully constructed set of questions which branch according to his responses

A very high degree of patient acceptance has been found This is for a number of reasons not the least of them being the personality which is built into the questionnaire In addition there appears to be no social or intellectual barrier between machine and patient as there may be with the doctor nor any feeling of embarrassment as is shown with the success of a computer questionnaire in psycho sexual medicine There is evidence that patients are more truthful and accurate in their responses to a computer They also appreciate being able to take their time over answering a question They do not feel as they may do in a conventional interview that they are taking up too much of the doctor's valuable time and that other patients are being kept waiting

At the end of the computer interview, a summary of the patient's responses is printed The doctor sees this summary immediately before seeing the patient The summary is concise and legible and laid out in the format which the doctor himself has specified On reading the summary the doctor gets a clear picture of the patient's general history The computer has collected the basic data so freeing the doctor to spend his time with the patient more fruitfully he may build up a better relationship with the patient and pursue his own questioning further Thus the computer interview helps patient doctor communication and is an aid to effective counselling

Tim Benson

[illegible] 2 years
[illegible]

# Apple II

## Unmatched flexibility and versitility from the world's best selling computer.

- Programmed EPROMs can be RUN while residing on PortWriter board.
- Optimum voltage and current for trouble free programming.
- Complete 2716 programmed in under 2 minutes (50 msec/byte).

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 106.05 | 15.91 | 121.96 |

### Musicsystem

This 16 voice digital synthesizer is said to set new standards to computer generated music. Its capabilities permit the creation of the sounds of real musical instruments utilizing the principle of additive synthesis. The generation of sounds is accomplished through fully programmable waveforms, envelopes and amplitudes for each musical voice. Provided with the hardware system is software for editing and playing of musical compositions. The Editor program permits graphical input of sheet music utilizing standard music notation. The Player program permits polyphonic performance of musical compositions. Stereo output is to users stereo amplifier and speakers or directly off card with stereo headphones.

MusicSystem generates the sound of any musical instrument – real or imagined – solo or sextex – rock or classical – at home or in the concert hall or classroom. MusicSystem permits virtuoso performance in computer generated music never possible before outside of research and development labs, and is a real breakthrough in low cost music generation.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 312.00 | 46.80 | 358.80 |

## California Computer Systems

| | Nett | Vat | Total |
|---|---|---|---|
| **Asynchronous Serial Interface** Price | 106.00 | 15.90 | 121.90 |
| **Synchronous Serial Interface** Price | 119.00 | 17.85 | 136.85 |
| **Parallel Card** Price | 79.00 | 11.85 | 90.85 |
| **Arithmetic Processor Unit** Price | 265.00 | 39.75 | 304.75 |
| **IEEE/GPIB Interface** Price | 199.00 | 29.85 | 228.85 |
| **Programmable Timer** Price | 106.00 | 15.90 | 121.90 |
| **A/D Converter** Price | 99.00 | 14.85 | 113.85 |
| **ROM/PROM Module** Price | 70.00 | 10.50 | 80.50 |
| **Centronics Card** Price | 79.00 | 11.85 | 90.85 |
| **Clock Card** Price | 83.00 | 12.45 | 95.45 |

## Interactive Structures
## D109 Universal Digital Interface

### Description

The D109 is a complete digital interface system on a single Apple II card. Plug it in and take control of 32 data lines each one able by your software as an input or an output. Add a current driver and operate relays or light switches directly. Add an isolation card and you're set to operate in the most hostile of industrial environments.

Use the on board timers to count events, generate precise square wave or interrupt your program when it's time for lunch. Combine the timers to measure up to 17 years. Use them individually to measure microseconds.

Set the D109 to interrupt you for any of 14 different reasons. Use the control lines to shake hands with other equipment when you have data to exchange. If you have 8 bits but only one wire serialize with the built in shift registers.

The D109 is a powerful new member of the Applecations(tm) Series. Plug it in and build a system that will surprise a few people.

### Features

- 32 digital input or output lines
- 4 programmable timers
- 2 shift registers
- full interrupt capability
- optional current drive and isolation.
- single Apple II card

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 213.00 | 31.95 | 244.95 |

## A1 – 02 Analog Converter Card

### What is the A1-02

The A1 02 is a single card system which allows Apple II* to look at analog, or non digitized information. This means that the Apple can sample temperature, measure light level or listen to sound and use the result as an input to a program. Since most of the quantities of interest in controlling a home environment or an industrial process are analog quantities, this opens a very large set of new applications to the Apple user.

### Analog Information

The A1 02 accepts information in the form of an analog voltage level in the range of 0 to 5.00 volts. Depending on the sensor used, this will correspond to a range of values such as 0°F to 212° or 5lbs. to 15lbs. of pressure.

### Input Channels

The A1 02 provides 16 separate channels for input. One channel at a time is selected by the program and the voltage present at the input when it is selected is the value returned to the program. There are no restrictions on the use of inputs: one may be selected repeatedly, all 16 may be selected in sequence, etc.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 192.00 | 28.80 | 220.80 |

## A0 – 03 Analog Output Board

### General Description

- Up to 8 independent channels
- Each channel digitally latched
- Range and offset adjustable
- Monotonic
- Accurate to 1/2 LSB

The AO-03 Analog Output system is a multi channel interface between the Apple II* microcomputer and the analog world. Using the AO 03 card, a BASIC or Assembly language program can in a single operation set or change an analog voltage level. Up to eight channels may be controlled with the outputs being truly parallel, latched digitally on the AO 03. Resolution of the digital to analog conversion is 8 bits and the output will settle to within one half LSB in 2 microseconds. The AO 03 is ideal for controlling light level, producing music and deflecting CRT, Plotter or LASER graphics systems.

(Continued overleaf)

Mail Orders to:
MICRODIGITAL LIMITED
FREEPOST (No stamp required)
Liverpool L2 2AB

Retail Premises at
25 BRUNSWICK STREET
LIVERPOOL L2 0PJ
Tel: 051 227 2535/6/7

Free delivery within mainland U.K.
12 month guarantee
All equipment tested before despatch
Bonafide official orders welcome.

Microdigital guarantees are extended to **2 years** on all Sharp and Apple hardware purchased after 1.1.8

# Apple II

## Unmatched flexibility and versitility from the world's best selling computer.

### Analog Outputs

Each output channel of the AO-03 is buffered and short circuit protected. The output range of voltages correspond to the binary codes thru 255. Each channel is individually adjustable for range and zero adjust. A strap may be inserted to shift from the standard positive voltage range to a bipolar range. Space is also provided for addition of components to smooth the output transitions for the lower bandwidth applications.

| Price | Nett | Vat | Total |
|---|---|---|---|
| 4 Channel | 180.00 | 27.00 | 207.00 |
| 8 Channel | 281.00 | 42.15 | 323.15 |

### Other Prices

| Price | Nett | Vat | Total |
|---|---|---|---|
| Applesoft firmware card for integer apples. | 116.00 | 17.40 | 133.40 |
| Integer Card – for applesoft apples | 116.00 | 17.40 | 133.40 |
| Programmers Aid I | 27.00 | 4.05 | 31.05 |
| Auto Start ROM Pack. | 38.00 | 5.70 | 43.70 |
| Apple Juice Back up power supply | 157.00 | 23.55 | 180.55 |

| | | | |
|---|---|---|---|
| Templeman dual 8" disk system – 1M byte. | 1550.00 | 232.50 | 1782.50 |
| Apple Desk – Two Tier | 145.00 | 21.75 | 166.75 |
| Apple Desk – Two Tier (Economy) | 125.00 | 18.75 | 143.75 |
| Printer Table. | 92.00 | 13.80 | 105.80 |
| Printer Table (Economy) | 87.00 | 13.05 | 100.05 |
| Single Tier Apple Desk. | 48.00 | 7.20 | 55.20 |

### Documentation

| | No. VAT £ |
|---|---|
| Apple II Reference Manual | 11.00 |
| 6502 Hardware Manual | 9.00 |
| 6502 Software Manual | 9.00 |
| Apple II Basic Programming Manual | 6.00 |
| Applesoft II Reference Manual | 6.00 |
| DOS 3.2 Manual | 6.00 |
| Apple II Basic Tutorial Manual | 6.00 |
| Autostart ROM Manual | 4.50 |

# Apple Software

All supplied on disk, unless otherwise specified.
Where integer basic is required this can be either

1. An integer Apple.
2. An Apple II + with integer card
3. An Apple II + with relocated integer
4. An Apple with language system

## Business Tools

### CCA DATA MANAGEMENT (48K APPLE Disk)

This system, developed by Personal Software, stores and retrieves information. It is very simple to learn and use and at the same time operates real data processing capabilities for you and your Apple. Allows you to prepare and access files for your mailing list, customer lists, expense reporting, budget analysis or any report you need.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 75.00 | 11.25 | 86.25 |

### DESK TOP PLANNER (48K APPLE Disk)

A unique financial planning and forecasting system that is driven by a simple menu system. Allows you to create business models or sub models and build up consolidated summaries if you have individual branches or cost centres. A best selling package available for the first time in the U.K.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 75.00 | 11.25 | 86.25 |

### VISICALC (32K APPLE Disk)

Visicalc provides an electronic worksheet of up to 63 columns and 254 rows. At the junction of any column and row you can type in words or numbers. Where you want the worksheet to perform a calculation, you type the formula. Visicalc automatically performs all arithmetic functions and instantly displays all of the results. If you change any of the numerical data, the electronic worksheet instantly displays a new result – automatically. Anyone who works with numbers – managers, financial analysts, accountants, engineers and scientists – will find Visicalc essential for their personal computer. Voted program of the year in the U.S.A.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 125.00 | 18.75 | 143.75 |

### Apple Plot

A useful addition to VisiCalc and Desktop/Plan systems which enables results to be plotted quickly and accurately. Multiple sets of data can be compared on the same report and displayed on the screen, in colour or a hard copy generated for reports, files etc. Apple Plot can be used independent of Visicalc and Desktop/Plan.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 37.00 | 5.55 | 42.55 |

### Apple Writer

Most probably the best word processing system available on a microcomputer for the price. Features include fast easy cursor control, moving blocks of text, delete by character, word, and paragraph, search and replace, left, right centre text justification.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 42.00 | 6.30 | 48.30 |

### Estate Agents

Developed in conjunction with a leading firm of Chartered Surveyors and Estate Agents, the system is a cost effective aid to residential property sales which quickly matches the property and applicants vice versa.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 500.00 | 75.00 | 575.00 |

### Mailing List

The system is a complete name, address and reference recording and management system for use in a wide variety of business operations. Up to 375 records can be held on each floppy disk. Features include add/amend/delete record, print records, print labels and various sort/selection facilities.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 70.00 | 10.50 | 80.50 |

## Games and Simulations

### INVASION ORION (32K APPLE Disk)

A complete tactical science fiction war game that provides you with scenarios designed to allow players of different skills to find a challenging game of space warfare every time. Choose from three levels of play for the computer. You can allow the computer to play either side.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 18.00 | 2.70 | 20.70 |

### MICROCHESS (16K APPLE Disk)

Perhaps the most famous chess game of all. Peter Jennings latest version written in machine code. It displays a graphic chess board and uses standard algebraic notation to describe the moves. You may set up special board situations and play them out against the computer. Should be well received at his low asking price. –Computing Today

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 15.00 | 2.25 | 17.25 |

### STAR FLEET ORION (32K APPLE – INTEGER ROM CARD Disk)

The program brings you the opportunity to fight space battles in your living room. 12 scenarios are provided in the game. These are of varying complexity with 2 to 5 spacecraft and playing times from 15 minutes to 6 hours. Starfleet Orion also includes a Rule Book, Battle Manual and Ship Control Sheets.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 18.00 | 2.70 | 20.70 |

### TEMPLE OF APSHAI (48K APPLE Disk)

This is a fantasy adventure but goes far beyond any other fantasy adventure game you may have seen for microcomputers. There are over 200 rooms, chambers and passages and over 30 different kinds of monsters guarding the many and varied treasures of Apshai. You'll spend hours or days wandering the ruins. "The Temple of Apshai is quite an experience. I am very pleased with it and rate it as one of my favourite PET programs. Len Lindsay – COMPUTE.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 22.95 | 3.44 | 26.39 |

### APPLE INVADERS (48K – PADDLES)

An excellent new rendition of the famous arcade game "Alien Invaders." Very competitive game with remarkable hi resolution graphics and high scoring. Good luck!

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 12.00 | 1.80 | 13.80 |

Mail Orders to
MICRODIGITAL LIMITED
FREEPOST (No stamp required)
Liverpool L2 2AB.

Retail Premises at
25 BRUNSWICK STREET
LIVERPOOL L2 0PJ
Tel 051 227 2535/6/7

free delivery within mainland U.K.
12 month guarantee
all equipment tested before despatch
bonafide official orders welcome

# Apple Software

### STAR VOYAGER (32K + INTEGER ROM CARD PADDLES)

A most challenging adventure in three parts. First destroy the evil emperor's city. Secondly dock with a military space station and finally defend yourself against space pirate ships. A three in one bargain.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 15.95 | 2.39 | 18.34 |

### SUPER STARWARS (32K + INTEGER ROM CARD JOYSTICK OR PADDLES)

Very realistic galactic battle with "floating sights" adding a very high degree of professionalism to a most acclaimed computer battle game.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 11.25 | 1.69 | 12.94 |

### CHECKER KING (16K APPLE Disk)

Personal Software's Checker King lets you play against your computer at eight levels of difficulty. A unique feature allows you to store in memory up to three board situations and replay them. All moves on the draughts board are automatically checked for legality.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 17.50 | 2.63 | 20.13 |

### DATESTONES OF RYN (48K APPLE Disk)

A dastardly robber band led by the notorious rogue, Rex the Reaver, has stolen the precious Datestones. Your mission is to recover the Datestones before Rex and his cut throats slip away. The Datestones of Ryn comes as a complete package ready to play including game program, 1200 byte data file and 16 page manual.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 12.95 | 1.94 | 14.89 |

### GAMMON GAMBLER (16K APPLE, Disk)

Become a Backgammon expert fast. Gammon Gambler provides ten levels of skill, from beginner to expert. The ideal way to learn to polish your game, because Gammon Gambler checks all of your moves for legality, lets you back up and correct your move and optionally displays the number of points. Backgammon rules are included in the manual.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 15.00 | 2.25 | 17.25 |

## Programming Aids

### ASSEMBLER EDITOR (48K)

A two pass assembler which is a compatible subset of the Fortran class assemblers available for 6500 series micros. This package incorporates the APPLEPIE text editor for the preparation of source code for assembly. Machine instruction source statements provide mnemonics codes for all machine instructions in the 6500 set as well as others set. File linkage facility allows simultaneous assembly of multiple source files.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 45.00 | 6.75 | 51.75 |

### DISK MAGIC (48K + INTEGER ROMCARD)

An invaluable programmer's utility. Enables the User to read and write information at the sector level without the constraints of the normal disk operating system. Repair damaged files, undelete files, extract report of free space available.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 16.00 | 2.40 | 18.40 |

### HI-RESOLUTION CHARACTER GENERATOR (48K + INTEGER ROMCARD)

The program gives unlimited potential for character designs. Animation can be displayed with a faster speed compared to using normal routines. The memory used is half that of using the normal hires routines. Each character set is 96 characters and two sets can be accessed by the keyboard at one time, that is 192 accessible characters under any one can be used allowing as many sets as your memory permits.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 16.50 | 2.48 | 18.98 |

### APPLEFORTH (16K + INTEGER ROMCARD)

A fast, interactive, compact language originally developed by astronomers for the control of their instruments. Run time overhead of only 70-100% compared with around 1000% for Applesoft interpreter. Software development times are also much shorter than for Assembler programming. Appleforth runs stand alone using the APPLE's unmodified monitor. Ver 1.0

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 39.95 | 5.99 | 45.94 |

### LARGE CHARACTER (32K + INTEGER ROMCARD)

Just low res graphics to display a message of up to 33 pages long. Each page contains three lines of up to six letters/numbers in colour. Ideal for point of sale advertising and display.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 16.00 | 2.40 | 18.40 |

### LISA (48K + INTEGER ROMCARD)

A powerful assembler. Symbolic and non symbolic addressing modes, macros and pseudo operation codes. A most essential tool.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 28.50 | 4.28 | 32.78 |

### MASTER CATALOGUE (32K)

An alphanumeric sorting and filing program. It makes full use of the Ampersand routine as described in leading magazines, will enable the user to delete a file, add a volume list file, sort by program name, sort by volume, find a program. Once you have more than one program disk it is invaluable.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 14.00 | 2.10 | 16.10 |

### SHAPE BUILDER (48K)

Brings hi-res graphics within reach of those unwilling to work with binary or hexadecimal. Gives full control over shape rotation and colour and is probably the best hires shaper available on the market.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 17.00 | 2.55 | 19.55 |

### TINY PASCAL (32K)

This language is a major only unlike full Pascal. It is compatible with Integer Basic and APPLESOFT, all of these languages can reach in, manipulate, and write out to each other. Tiny Pascal includes very comprehensive documentation and programming examples. As favourably reviewed in BYTE magazine in America.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 40.00 | 6.00 | 46.00 |

### LISP

The system consists of 8k bytes of machine code interpreter plus 4k bytes of initialised LISP workspace containing LISP utilities and constants. It is supplied on disc with a 44 page manual for a 16k or larger computer. Two demonstration programs are included. The system has been designed with ease of use in mind.

The fast compacting garbage collector automatically finds space for numbers, lists or character strings if there is any space at all remaining. This means that the programmer need never be concerned about the details of storage allocation. Supplied on Disk. Requires 32K System

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 58.00 | 8.70 | 66.70 |

## Scientific

### INDEX FILE (48K + INTEGER ROMCARD)

Provides facilities for new files, accessing data on existing files, recovering record data by adding records, deleting records and modifying records. Also contains fast string search facility.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 16.00 | 2.40 | 18.40 |

### FUNCTION PLOT (48K)

The program plots two dimensional functions using hi resolution graphics. The functions can be simple or complicated and assists visualisation of types of co-ordinate systems. Plots rectangular or polar co-ordinates. Rectangular co-ordinates can be linear, logarithmic or semi logarithmic. Axes are clearly labelled and several examples are shown within the program.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 18.50 | 2.78 | 21.28 |

### STATISTICS (24K)

A pack of six programs allowing the following statistical tests: Mean, Variance and Standard Deviation, Binomial, Normal Distribution Probability and Frequency, Chi Square Distribution, Chi Square Test and T Test. A practical business aid that is very simple to execute.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 19.95 | 2.99 | 22.94 |

## Tutorials

### STEP BY STEP (32K)

The famous tutorial for the APPLE. Comes complete with a sixty page manual. Ideally suited to the first time user and beginner. Its method of teaching will ensure that programming skills quickly become habit.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 25.00 | 3.75 | 28.75 |

### Maths Sequences

A comprehensive software curriculum in mathematics for children aged 5-10. Topics covered range from simple arithmetic through to laws of arithmetic and negative numbers. Instruction is completely individualised based on each student's needs and abilities. The program sets a success criterion and allows the student to work at his own pace towards the objectives. As well as all this each student's progress is monitored thus allowing the teacher to review the progress of all students in a matter of minutes.

| Price | Nett | Vat | Total |
|---|---|---|---|
| | 200.00 | 30.00 | 230.00 |

## Other Software

| Price | Nett | Vat | Total |
|---|---|---|---|
| Contributed Software 1 2 | 27.00 | 4.05 | 31.05 |
| Contributed Software 3 5 | 60.00 | 9.00 | 69.00 |
| Dos utility pack | 15.00 | 2.25 | 17.25 |
| Apple Pied | 27.00 | 4.05 | 31.05 |
| Apple Bowling | 9.00 | 1.35 | 10.35 |
| Dollar Invaders | 13.00 | 1.95 | 14.95 |
| Apple Adventure | 21.00 | 3.15 | 24.15 |
| Checker King | 15.00 | 2.25 | 17.25 |
| Bridge Partner | 14.00 | 2.10 | 16.10 |

Mail Orders to
MICRODIGITAL LIMITED
FREEPOST (No stamp required)
Liverpool L2 2AB

Retail Premises at
25 BRUNSWICK STREET
LIVERPOOL L2 0PJ
Tel 051 227 2535/6/7

Free delivery within mainland U.K.
2 year guarantee
all equipment tested before despatch
bona fide official orders welcome

# Books

We have been supplying a wide range of microcomputer books for over two years now and we are probably the largest supplier in the country. We stock far more titles than those listed in this brochure for browsers in our Liverpool shop. All prices include postage and packing and we welcome official orders from bona fide commercial educational and government organisations.

We hold enormous stocks so as to ensure a rapid turn around on your order.

## SYBEX BOOKS

**Introduction to Personal and Business Computing by R. Zaks** 4.90
A [illegible] yet simple [illegible] whether [illegible]

**Microprocessors – From Chips to Systems by R. Zaks** 6.95
The basic [illegible] with [illegible] background. [illegible]

**Microprocessor – Interfacing Techniques by R. Zaks** 9.90
This [illegible] techniques [illegible] hardware [illegible] software.

**Programming the 6502 by Rodney Zaks** 7.90
[illegible] 6502 [illegible] programming knowledge [illegible] 6502. An [illegible] PET Apple [illegible]

**6502 Applications Book** 7.90
This book [illegible] for the 6502 [illegible]

**Programming the Z-80** [illegible]
Another in the highly successful Sybex Series by Rodney Zaks. [illegible] Assembly Language [illegible] Z-80.

**Your First Computer by Rodney Zaks** [illegible]
A [illegible] CP/M and [illegible]

**The CP/M Handbook by Rodney Zaks** 8.90
CP/M [illegible] operating systems. Now SYBEX makes CP/M [illegible] step by step [illegible] HANDBOOK [illegible] anyone using or contemplating CP/M [illegible] applications programs.

**Programming the Z8000 by Richard Mateosian** 7.90
This book describes [illegible] the Z8000 [illegible] machine language programming [illegible] Z8000 programs to [illegible] complicated [illegible] anyone interested in the Z8000 [illegible] PDP 11 [illegible] PDP 11 system to a Z8000 system [illegible] easy one.

## OSBORNE BOOKS

**Practical Basic Programs** [illegible]
Every [illegible] 40 [illegible] BASIC [illegible] problems [illegible]

**Z-80 Assembly Language Programming** [illegible]
These books [illegible] assembly language [illegible] microcomputer system and [illegible]

**6502 Assembly Language Programming by Leventhal** [illegible]
Another [illegible] Assembly Language series [illegible]

**PET and the IEEE 488 Bus (GPIB) by Fisher & Jensen** 9.90
A book for [illegible] designers [illegible] hobbyists [illegible]

**Introduction to Microcomputers by A. Osborne – Volume 0: The Beginners Book** 5.90
If you know [illegible] about computers this is the book to begin with. It explains what computers [illegible] and describes their components.

**Introduction to Microcomputers by A. Osborne – Volume 1: Basic Concepts** [illegible]
This [illegible] All the basic hardware and software [illegible]

**Introduction to Microcomputers – Osborne (September 1978 Edition)** [illegible]

**Volume 2 – Some Real Microprocessors** [illegible]
[illegible] support devices [illegible] microprocessors.

**Volume 3 – Some Real Support Devices** – [illegible] [illegible]
A companion volume to Volume 2. [illegible]

**Some Common BASIC Programs** [illegible]
Includes 76 short programs [illegible] mathematics [illegible]

**Z-80 Programming for Logic Design** [illegible]
[illegible] assembly language. [illegible] the programmer and the logic designer [illegible]

## HOWARD SAMS BOOKS

**Microcomputer Primer by M. Waite and M. Pardee** [illegible]
[illegible] explained.

**Getting Acquainted with Micros by L. Frenzel** [illegible]
[illegible] especially [illegible] equally available to the layman.

**Computer and Programming Guide for Engineers by D. Spencer** [illegible]
Written specifically for the Engineer or Scientist. The book explains [illegible] how it works and how it can be used to the best advantage. Details FORTRAN and BASIC programming.

**TTL Cookbook by D. Lancaster** [illegible]
Describes what transistor-transistor logic is, how it works and how to use it. [illegible] how to build TTL systems [illegible]

**CMOS Cookbook by D. Lancaster** [illegible]
[illegible] complete guide to the understanding and use of Complementary Metal [illegible] circuits. Gives [illegible] examples [illegible] logic.

**TV Typewriter Cookbook by D. Lancaster** [illegible]
A [illegible] guide to low [illegible] display of alpha numeric and graphic [illegible] video games.

**Cheap Video Cookbook by D. Lancaster** [illegible]
A [illegible] TV Typewriter Cookbook [illegible]

**How to Program Micros by W. Barden Jnr** [illegible]
Explains assembly language programming [illegible] based on the 8080 [illegible] number systems and [illegible]

**Z-80 Microcomputer Handbook by W. Barden Jnr** [illegible]
[illegible]

**Microcomputers for Business Applications by W. Barden Jnr.** [illegible]
This book will prove invaluable [illegible] business [illegible] microcomputer system [illegible] complete turnkey system [illegible] software.

**The S-100 and Other Micro Buses by Poe and Goodwin** [illegible]
This book [illegible]

**BASIC Primer by Waite and Pardee** [illegible]
[illegible] BASIC programming [illegible]

**Z-80 Microprocessor Programming and Interfacing Volume 1 by Nichols and Rony** [illegible]
This [illegible] Z-80 [illegible] programming [illegible] Z-80 Book 2 [illegible] background in computers.

**Z-80 Programming and Interfacing Book 2 by Nichols and Rony** [illegible]
[illegible] Z-80 CPU, PIA and CTC [illegible] Book 1.

**Industrial Process Control Systems by Patrick and Fardo** [illegible]
[illegible] applications and daily operations [illegible] book.

Mail Orders to
MICRODIGITAL LIMITED
FREEPOST (No stamp required)
Liverpool L2 2AB

Retail Premises at
25 BRUNSWICK STREET
LIVERPOOL L2 0PJ
Tel: 051 227 2535/6/7

[illegible]

# Books

**TRS-80 Interfacing by J.A. Titus** [illegible]

[illegible]

**The Howard W. Book Crash Course in Microcomputers by L. E. Frenzel** [illegible]

[illegible]

**Computer Graphics Primer by M. Waite** [illegible]

[illegible]

**6502 Software Design by L. Scanlon** [illegible]

[illegible]

**Z-80 Microcomputer Design Projects by W. Barden Jnr** [illegible]

[illegible]

## BUTTERWORTH BOOKS

**Book BASIC by J. Coan** [illegible]

[illegible]

**Advanced BASIC by J. Coan** [illegible]

[illegible]

**FORTRAN Fundamentals – A Short Course by Jack Steingraber** [illegible]

[illegible]

**Programming for Microprocessors by Andrew Colin** [illegible]

[illegible]

**Sargon: A Computer Chess Program by Dan and Kathe Spracklen** 9.45

[illegible]

**The Systems Analyst by J. Attwood** (Hardback) [illegible]

[illegible]

**How to build a Computer-Controlled Robot by Tod Loofbourrow** [illegible]

[illegible]

**How to Profit from your Personal Computer – Professional, Business and Home Applications by T. G. Lewis** 5.45

[illegible]

**FORTRAN with Style** [illegible]

[illegible]

**BASIC with Style** 3.90

[illegible]

**Home Playing with BASIC by D. Spencer** [illegible]

[illegible]

**Sixty Challenging Problems with BASIC Solution** 5.90

[illegible]

**Problems for Computer Solution** 5.10

[illegible]

## CREATIVE COMPUTING BOOKS

**Computers in Mathematics** 10.90

**A Sourcebook of ideas edited by David H. Ahl**

[illegible]

**BASIC Computer Games by David Ahl** 5.45

[illegible]

**More BASIC Computer Games by David Ahl** 5.45

[illegible]

## ADDISON – WESLEY BOOKS

**Artificial Intelligence by Winston** [illegible]

[illegible]

**Problem Solving and Structured Programming in BASIC by Koffman and Friedman** [illegible]

[illegible]

**The Little Book of BASIC Style by Nevison** [illegible]

[illegible]

**A Guide to BASIC Programming by Spencer** [illegible]

[illegible]

**Introducing System Design by Squire** [illegible]

[illegible]

**Software Tools by Kernigan and Plauger** [illegible]

[illegible]

**BASIC and the Personal Computer by Dwyer & Critchfield** [illegible]

[illegible]

**Problem Solving and Structured Programming in FORTRAN by Friedman & Koffman** [illegible]

[illegible]

**A Course in APL with Applications by Grey** [illegible]

[illegible]

**Programming in PASCAL by Grogono** [illegible]

[illegible]

**Programming a Microcomputer (6502) by Foster** 7.20

[illegible]

**The Computer — An Everyday Machine by Squire** [illegible]

[illegible]

Mail Orders to:
MICRODIGITAL LIMITED
FREEPOST (No stamp required)
Liverpool L2 2AB

Retail Premises at:
25 BRUNSWICK STREET
LIVERPOOL L2 0PJ
Tel: 051-227 2535 6 7

[illegible]

# Books

**The Art of Computer Programming Volume 1 – Fundamental Algorithms by Knuth** 9.10
This is the first book of the world wide best selling series and thought by many as the best books of their type available. Volume 1 begins with a thorough review of the mathematical techniques used, although the book [illegible] not assume mathematics above high school level [illegible] reader. It goes on to review assembly [illegible] programming and ends with a 200 page review of information structures. The book [illegible] exercises.

**The Art of Computer Programming Volume 2 – Semi-Numerical Algorithms by Knuth** 16.40
This book covers random numbers, random sequences, statistical tests, floating point arithmetic, [illegible] arithmetic, polynomials etc. This book offers a course aimed [illegible] knowledge of computer programming and [illegible] including a substantial amount of complexity and [illegible] assumes A level mathematics capability.

**The Art of Computer Programming Volume 3 – Searching and Sorting by Knuth** 20.40
The [illegible] comprehensive survey of these computer techniques ever published. The material is presented such that the general principles are applicable to a wide range of problems. Some knowledge of computer techniques and elementary calculus is assumed.

**COBOL – An Introduction to Structured Logic and Design** 8.90
The introductory text stresses the logical development of solutions in common business data processing.

### SIGMA BOOKS

**Computer Programs that Work by Lee, Beech and Lee** 3.95
This book contains twenty [illegible] programs in BASIC in the areas of biology, mathematics, chemistry and physics and includes simulations of real life situations and popular games.

**Z-80 Instant Programs (Nascom)** 7.50
These machine code routines can be entered into a Z-80 system etc. and are applicable to even the smallest machines. The routines average 1000 instructions.

### COMPUSOFT BOOKS

**Learning Level II BASIC by David Lien** 11.00
This is the second and excellent book by Compusoft Publishing in California. No TRS-80 owner [illegible]

**The BASIC Handbook by David Lien** 11.00
The [illegible] BASIC on most personal computers [illegible] shows the [illegible] the new ANSI standard BASIC. It is the only book of its kind in print at present.

### SCELBI BOOKS

**Understanding Micros by N. Wadsworth** 7.90
If you are at all curious about small computer systems you must own this inexpensive text which explains all the fundamental concepts behind the operation of [illegible] computers.

**Calculating with BASIC** 7.90
Here is a variety of programs in BASIC to help apply the language to practical problems. The book covers problems in finance, statistics, engineering, mathematics and electronics. Good descriptions and examples are provided with each program listing.

**PIMS Personal Information Management System** 7.45
This book is a ready to use data base system in Microsoft BASIC with full instructions. An excellent starting point for your home [illegible] systems.

### WELLER BOOKS

**Practical Microcomputer Programming with the Z-80 by Weller** 19.50
[illegible] programming [illegible] Debugging techniques, [illegible] handling, [illegible] floating point arithmetic, programmed [illegible] output stack pointer usage. The book includes an extra assembler listing for Z-80 and 8080. If you return the coupon at the back of the book you receive either paper tape or TRS-80 cassette of the object code for the assembler.

### DILITHIUM BOOKS

**Instant BASIC by G. Brown** 7.15
Here for the microcomputer enthusiast is finally a book to teach you BASIC [illegible] in a non-mathematical context [illegible] graphics. This book is fun to use.

**Beginning BASIC by P. Chirlian** 7.45
An introduction to BASIC for beginners written in response to the author's children's [illegible] BASIC.

**Starship Simulation by R. Garrett** 5.40
[illegible] the game and it can be [illegible]

**32 BASIC Programs for the PET Computer by Rugg & Feldman** 9.70
32 fully [illegible] programs for the PET computer [illegible] documented programs [illegible] PET computer. You also have the option of making a number of changes as suggested, to these programs if you wish.

**Introduction to TRS-80 Graphics by D. Inman** 6.40
For some time now graphics displays on microcomputers have been out of the reach of hobbyists because of their complexity and high cost. In this book the author will show you how with a minimal knowledge of the BASIC computer language and your TRS-80 [illegible] you can create graphic displays that only a few years ago were the exclusive world of the big computer owners. The book begins with the basics and works from line drawings through geometrics and right on up to moving figure animation and more advanced operations. A great handbook on computer graphics for microcomputer owners at all levels of experience.

**How to make money with your Microcomputer by Townsend & Miller** [illegible]
The microcomputer you own can be used as a lever to multiply your time and [illegible] given power. It can do many jobs the individual [illegible] much less time than you could do them by hand. The possibilities are limited by your own creativity. This book will give a start with [illegible] money making ideas.

**MICROSOFT (TM) BASIC by Knecht** [illegible]
A full [illegible] TRS-80 [illegible] presents an introduction and tutorial on programming in MICROSOFT BASIC. The concepts presented are illustrated with examples that [illegible]. By starting with the simplest and most commonly used commands and then progressing on to the more complex instructions, the author [illegible] the more powerful versions of the BASIC language [illegible] save time and effort. Only an understanding of Computer fundamentals is required [illegible] the book and the language is applicable to most small systems including the Apple and the PET.

**Peanut Butter and Jelly Guide to Computers by Jerry Willis** 4.35
This book is a welcome treat [illegible] of personal computers [illegible] book with details you need to know [illegible] easy to understand [illegible] wealth of information for the expert.

### MISCELLANEOUS

**Best of Micro – Volume 1** 5.45
Micro is the best known and most widely read of the specialist journals dealing with the 6502 [illegible] used in the PET, Apple, Aim, OSI, Compukit, Microtan etc. 'Best of Micro' is a bound version of the first six issues.

**Best of Micro – Volume 2** 6.45
This [illegible] bound version of the second six issues of Micro up to mid 1979.

**The Mighty Micro by Chris Evans** 5.75
This [illegible] the well known ITV [illegible] version [illegible] Adam [illegible] book.

**Illustrating Basic — a simple programming language by D.Alcock** 3.25
One of the best selling books on BASIC, its clear explanation, attention to details, [illegible] have won it a strong and a [illegible]. 'You don't have to be a computer specialist to read this book. It is for students meeting computers for the first time [illegible] industry (particularly engineers) who have [illegible] who would like to write a simple computer program [illegible] who don't want to become programmers but would like to know more [illegible] often have to take decisions, and for those who can already write BASIC but seek a broader view of portable programming and [illegible] programmer's techniques like state tables and [illegible]

### OTHER TITLES

| | |
|---|---|
| **API Implementation** | 14.70 |
| **MICROPROCESSOR LEXICON** | [illegible] |
| **A - Z of Computer Games** | [illegible] |
| **Artificial Intelligence (TAB5)** | [illegible] |
| **Basic Basic Programming** | [illegible] |
| **Basic Cookbook** | 3.90 |
| **Basic Comp Progs for the Home** | 6.45 |
| **Basic Comp Progs Science & English** | 6.45 |
| **Basic from the ground up** | [illegible] |
| **Basic Workbook** | 4.90 |
| **Beginning FORTRAN** | [illegible] |
| **Pascal for PET (TCL)** | 8.45 |
| **Computer Programming Handbook** | 7.20 |
| **Computer Technicians Handbook** | [illegible] |
| **Micros & the 3R's** | [illegible] |
| **Fortran With Style** | 4.70 |
| **Industrial Process Control Systems** | 8.90 |
| **Introduction to VLSI systems** | 10.90 |
| **Introduction to T BUG** | 6.70 |
| **Modern Digital Communications** | 5.90 |
| **37 Practical Progs & Games** | 5.70 |
| **S-100 Bus Handbook** | [illegible] |
| **Some Common Basic Programs/PET** | [illegible] |
| **24 Tested Ready to Run Progs** | 4.70 |
| **TRS-80 Disc & Other Mysteries** | 11.90 |
| **TRS-80 Interfacing Book 1** | 6.90 |
| **Z80 Instant Programs** | 7.45 |
| **Z80 Instruction Handbook** | 3.05 |
| **Z80 Micro Design Projects** | 9.10 |
| **8086 Primer** | 6.45 |
| **Using FORTH** | 19.20 |
| **Programming and Interfacing the 6502** | 8.90 |
| **Pascal With Style** | 4.70 |
| **Games on your doorstep** | 5.70 |
| **Basic Digital Electronics** | 3.90 |
| **PET Personal Computer Guide** | [illegible] |
| **Digital Interfacing with an Analog world** | 6.45 |
| **Introduction to Structured FORTRAN** | 9.20 |
| **Microcomputer Systems Principles featuring 6502/KIM** | 9.20 |
| **Microprocessor Systems Engineering** | 4.90 |
| **The ZX80 Pocket Book** | 4.95 |
| **Modern Guide to Digital Logic** | 5.70 |
| **Programming Microprocessors** | 4.90 |
| **6502 Cookbook** | 7.70 |
| **6502 Games** | 8.90 |

Mail Orders to:
MICRODIGITAL LIMITED
FREEPOST (No stamp required)
Liverpool L2 2AB.

Retail Premises at
25 BRUNSWICK STREET
LIVERPOOL L2 0PJ
Tel. 051/227 2535/6/7

Free delivery within mainland UK
12 month guarantee
all equipment tested before despatch
Institutions official orders welcome

MICRODIGITAL MICRODIGITAL MICRODIGI

# LIVERPOOL SOFTWARE GAZETTE

The magazine for the microcomputer user. Authoritative articles on a wide range of software topics. Published bi-monthly

Send a £9 cheque payable to Liverpool Software Gazette for 12 issues. State whether you wish to start with issue 1 2 3 4 5 6 7

# Video Monitors

Microdigital can supply a wide range of video monitors, suitable for any situation.

**Astec 10" Monitor**

An economic monitor which provides a clear picture

| Price | Nett | Vat | Total |
|---|---|---|---|
| Astec | 85.00 | 12.75 | 97.75 |

**Hitachi 9" Monitor (VM910)**

A standard monitor very reliable

| Price | Nett | Vat | Total |
|---|---|---|---|
|  | 127.00 | 19.05 | 146.05 |

**Hitachi Hi-Res 9" Monitor (VM906)**

As above but with a finer tube giving clearer viewing

| Price | Nett | Vat | Total |
|---|---|---|---|
|  | 148.00 | 22.20 | 170.20 |

**Hitachi 12" Monitor (VM129)**

Excellent value for this superb Video monitor a must for professional users. Extremely clear viewing

| Price | Nett | Vat | Total |
|---|---|---|---|
|  | 189.00 | 28.35 | 217.35 |

**12" Green Screen Monitor (VM 12G)**

An excellent clear green screen monitor comes complete with anti glare shield.

| Price | Nett | Vat | Total |
|---|---|---|---|
|  | 162.00 | 24.30 | 186.30 |

Colour monitors. Ring for prices and details.

# Memory Chips

● **New low price**

We buy memory in enormous quantities, as a result we can afford to sell memory chips at really comprehensive prices. Any faulty chips should be returned to us within 12 months of purchase with proof of purchase for replacement by return of post.

4116 memory chips guaranteed to 200 nanosecond full cycle time. Suitable for Apple, TRS80, Nascom, Exidy Sorceror, Sharp MZ80K etc.

| Price | Nett | Vat | Total |
|---|---|---|---|
| 8 x 4116 chips (16K bytes of memory) | 16.00 | 2.70 | 20.70 |
| 25 x 4116 chips | 48.00 | 7.20 | 55.20 |
| 100 x 4116 chips | 160.00 | 24.00 | 184.00 |

2114 memory chips guaranteed to 300 nanoseconds full cycle time. Low power suitable for Superboard, Compukit, Atom, ZX80 etc.

| Price | Nett | Vat | Total |
|---|---|---|---|
| 2 x 2114 chips (1K byte of memory) | 4.00 | 0.60 | 4.60 |
| 25 x 2114 chips | 46.00 | 6.90 | 52.90 |

# Scotch 7440 Head Cleaning Diskettes

Keeping the heads free of debris means longer lasting heads, fewer diskette replacements and fewer engineer calls. The rotating cleaning fabric in the head cleaning diskettes alternately wipes the heads with the solution and dry surface removing contamination from the read/write heads. In half a minute the heads are clean.

The cleaning diskettes can be used with either single or double headed diskette drives. The 7440 kit is for all 5¼" minidiskette drives. The kit contains one bottle of cleaning solution one dispenser cap and two cleaning diskettes. Each cleaning diskette can be used for approximately 15 cleanings.

Materials and solution are completely safe being non flammable non-abrasive and will not harm metals plastics or painted surfaces. Too little or too much cleaning solution will not affect the drive.

| Price | Nett | Vat | Total |
|---|---|---|---|
| 7440 kit | 29.50 | 4.43 | 33.93 |

# Cassettes

We are probably the largest supplier of microcomputer cassettes in the country and have them specially manufactured to our quality specification.

- C15 Agfa Tape
- Special Labels
- Cellophane wrapped
- Precision transport mechanism
- Leaderless
- Insert Cards
- Screw fixing case
- Proven performance

| Prices | Nett | Vat | Total |
|---|---|---|---|
| one cassette | 0.80 | 0.12 | 0.92 |
| box of ten cassettes | 5.20 | 0.78 | 5.98 |
| fifty cassettes | 25.00 | 3.75 | 28.75 |
| one hundred cassettes | 45.00 | 6.75 | 51.75 |

**Guarentee**

If within 12 months of purchase any of our cassettes does not give satisfactory performance send it back to Microdigital for replacement by return of post.

# Disks

High performance Mini Floppy disks

- Anti static envelopes
- soft sectored
- single sided, single density
- free library cases (with 10 or more disks)
- labels and write protect tabs supplied

| Prices | Nett | Vat | Total |
|---|---|---|---|
| one disk | 3.00 | 0.45 | 3.45 |
| ten disks | 22.00 | 3.30 | 25.30 |
| fifty disks | 100.00 | 15.00 | 115.00 |
| one hundred disks | 180.00 | 27.00 | 207.00 |

CRA LASKYS VISA

Mail Orders to:
MICRODIGITAL LIMITED
FREEPOST (No stamp required)
Liverpool L2 2AB

Retail Premises at
25 BRUNSWICK STREET
LIVERPOOL L2 0PJ
Tel 051 227 2535/6/7

free delivery within mainland U.K.
12 month guarantee
all equipment tested before despatch
bonafide official orders welcome

MICRODIGITAL MICRODIGITAL MICRODIGI

# Microdigital Mail Order Form

| Office Use only | Goods required | Price |
|---|---|---|
| | 1 | |
| | 2 | |
| | 3 | |
| | 4 | |
| | 5 | |
| | 6 | |
| | 7 | |
| | 8 | |
| | Total | |

[illegible] ☐

Date

Acces 5224 ☐☐☐ ☐☐☐☐☐ ☐☐ ☐

Barclaycard 4929 ☐☐☐ ☐☐☐ ☐☐☐

Expiry date

Name

Address

Post Code

Tel (day)

**CA**

## Lasky's Stereoclub

the easy way to buy from Microdigital.

For as little as £5 per month, you can join the Lasky's Stereoclub with [illegible] credit limit of 24 times your monthly repayment, and enable you to buy **now** the microcomputer equipment that you've always wanted from Microdigital. [illegible] interest rate is 2.5% monthly [illegible] 74 [illegible]

As a Stereoclub member we'll send you regular news [illegible] and Microdigital. Lasky's Stereoclub is probably the best thing that happened [illegible] microcomputers since the invention of the chip!

## Microdigital Limited

Microdigital Limited is registered in England

Registered Number 31[illegible]6437

Registered Office: Chancel House, Neasden Lane, London NW1[illegible]

Directors P.M. George, P. Klein, G.W. Ralph, A.J. Sh[illegible]ng, [illegible]

Ultimate Holding Company: Ladbroke C[illegible] Limited

VAT Number 240 1132 31

## Terms and Conditions

In addition to cash we accept Access, Barclaycard [illegible] cheques covered by a bankers card.

Allow one week for personal cheques to clear.

VAT in this brochure has been calculated at the rate of [illegible] current at the time of writing. Please allow for any changes.

Postage and carriage is offered free of charge within the United Kingdom.

All products are covered by our 1 year warranty against failure due to faulty materials or workmanship.

Official orders over £[illegible] are welcome, with normal 14 days credit extended to bona fide commercial and government organisations.

All prices, specifications and terms are subject to change without notice at the discretion of the management.

The entire contents of the brochure are copyright Microdigital Limited 1981

## Microdigital 12 month Guarantee

Microdigital Ltd. (hereinafter called the company) warrants the product(s) against defects in material and workmanship for a period of one year from the date of purchase.

During the warranty period the company will repair or at its own option replace at no charge components that prove defective. This is provided the product is returned shipping prepaid to [illegible] Brunswick Street, Liverpool 2, L2 0PJ stating when it was bought and enclosing proof of purchase.

The warranty does not apply if in the opinion of the company the product has been damaged by accident, misuse, misapplication or in the case of a kit bad construction.

## Ansaphone Service

24 Hr 7 Day

Ansaphone Service

on 051 236 0707

## Opening Hours

Shop 9 [illegible] Mon Sat

closed Bank Holidays.

Mail Order [illegible] 5 Mon Fri

**Prices correct at time of going to press**

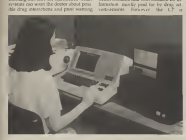
Mail Orders to
MICRODIGITAL LIMITED
FREEPOST (No stamp required)
Liverpool L2 2AB

Retail Premises at
25 BRUNSWICK STREET
LIVERPOOL L2 0PJ
Tel 051 227 2535 6/7

free delivery within mainland UK
12 month guarantee
all equipment tested before despatch
bonafide official orders welcome

## Medicine

be valued by the pharmacist Perhaps more importantly a computerised repeat prescription system can monitor prescribing It will check the length of time since the last prescription and indicate whether the patient should see the doctor This gives the doctor reassurance that he is not being asked to prescribe drugs to patients for years on end without regularly checking that they are still needed Some systems can warn the doctor about possible drug interactions and print warning notices for the patient advising him about not taking certain non prescription drugs or foods



Every day the GP's letterbox is full of free magazines circulars and so on which overload him with unasked-for information mostly paid for by drug advertisements However the GP is dependent on external sources of information about drugs and other developments in medicine The ideal situation for the doctor would be to have this information readily available but at his own control The development of PRESTEL has aroused considerable interest because it offers selective access to large central data banks The information providers could be the DHSS or the large drug companies The cost of telephone charges is a deterrent to the widespread use of PRESTEL One way of overcoming this problem would be for each practice to keep its own information data base locally on its own computer This could be refreshed from time to-time by down loading updates from the central PRESTEL computer Such a system could also give direct access to computerised medical literature search systems such as BLAISE and MEDLINE

It has now become clear which activities in general practice can be computerised with the greatest benefits to patients and doctors If computers really do help provide better medical care it might well be in your own interest that he has one Perhaps you should organise a summer fete to help your doctor buy a computer ■

• *Tim Benson was head of the Computer Evaluation Unit at the Charing Cross Hospital London for six years from 1974 to 1980 He set up ABIES Informatics in 1980 ABIES Informatics is a systems house specialising in the field of medical information systems and is at 38 Dover Street London W1 Tel 01–491 7507*

## Specialist applications software to meet your needs.

Characterised by cost effectiveness and ease of use

**MICKIE®**
The automatic questionnaire and reporting system
**Autotext**
The complete word processor
**RMS**
The versatile data base management system
**Dental management**
Comprehensive integrated package
**Patient register**
The key to practice information
**Prescribing**
Repeat prescriptions and analysis
**Dispensing**
Drug labels and stock control
**Business applications**
Sales, purchase and nominal ledgers, invoicing, stock control and payroll

abies
**Informatics**

38 Dover Street Tel 01-491 7507
London W1X 3RB Telex 268913

®MICKIE is a trademark of the National Physical Laboratory

**Abies informatics computer systems for general practitioners, dentists and veterinary surgeons.**

# A Medical Monitor

*Another angle to the use of a microcomputer in a general practice*

The trouble with medicine today is that there is too much of it: every year brings new discoveries about diseases and treatment which every practising doctor is required to absorb. People's expectations, about the quality of their treatment, also rise annually – always ahead of government expenditure. Varicose veins, for instance, which were an accepted fact of life twenty years ago, are now a common reason for being put on a surgeon's waiting list.

Every new television programme about an obscure or rare disease brings people flocking to surgeries for reassurance, so much so, that family doctors dread this kind of medical education.

It is in this health conscious (if not hypochondriac) atmosphere that the family doctor has to work. The average doctor has the responsibility, from birth to grave, for 2500 patients. He is expected to care for them with unbounded devotion – always kind, always available, and never wrong. One mistake can cost him his career, a single lawsuit could face him with a bill for £500 000 – enough to turn any doctor sick.

Consider that a high percentage of his workload consists of routine sick notes, chronic emotional problems, repeat prescriptions, the reassuring of patients, and you may indeed wonder how he manages to monitor and control his practice at all.

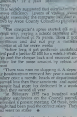
Worse, the payments a doctor receives are very complex, some relating to single acts such as fitting a contraceptive device. Each item must be recorded and an invoice raised. No wonder that a doctor may spend an entire weekend every month doing the accounts.

It is not surprising, then, to read of a woman with high blood pressure, who failed to attend surgery for a check up and more drugs, whose case was not followed up and who, after a severe stroke, was dead on arrival at hospital.

Monitoring a practice is a problem caused by the low ratio of doctors to patients, the rising expectations of the public and complex administration.

> *'He is expected to care for them with unbounded devotion – always kind, always available; and never wrong.'*

A friend or relative – or you – may be suffering from a disease, the cause of which is unknown. Even more distressing is that a *cure* may also be unknown – or untried. Examples of such diseases are high blood pressure, arteriosclerosis, cancer, multiple sclerosis, etc. But collecting information on vast numbers of different patients is time consuming, immensely expensive and, at present, almost impossible.



**End-of-tether report:**
*Generosity? To a fault* [illegible]
*change*
"It is widely suggested that [illegible] improve efficiency. Lovers of [illegible] might remember the computer [illegible] 1975 by Avon County Council [illegible] wages.

"The computer's spree started in a small way, paying a school caretaker £75 an hour instead of 75 pence. Then it got ambitious and did not pay a [illegible] worker at all for seven weeks.

"Before long it got positively confident and paid a janitor £2 600 for a week's work. He sent the cheque back and received another for the same amount by return of post.

"There was now no stopping it. A deputy headmistress received her year's annual salary once a month, heads of department earned less than their assistants, and some people had more tax deducted in a week than they earned all year.

"In February 1975 two hundred and eighty employees on the Council payroll attended a protest meeting. Of these, only eight had been paid the correct salary. They all went on strike. ●

From *The Book of Heroic Failures* by Stephen Pile. Published by Futura at 95p. Hilarious

Hospital research is easier. A hospital has notes in a fairly standard format for many thousands of patients, but data on ordinary patients seen and cured by family doctors scattered throughout the UK is extremely hard to come by. Collecting information from a score of practices in a standard way is a problem in itself; actually analysing the data to produce a useful result is formidably difficult.

Another problem: it is not enough to see a patient and make a diagnosis; treatment must be both effective and safe. The reason why it took so long to spot thalidomide as a cause of congenital deformity was precisely the problem outlined above. It is almost impossible for a drug company to monitor, country wide, the effects of a drug on one or two patients in each of five or six thousand different practices. Often detection of patterns depends on the intuition of an alert doctor — and he may be too late. So a cheap device to record information about every patient visit could have an enormous and lasting impact on the level and quality of health care.

The system we describe runs on a 32K PET with a cassette recorder and an optional printer. It is simple, reliable, cheap and requires only a *few seconds* of a doctor's time for each consultation. The bulk of the work, perhaps as little as one hour per week typing in codes, is done by an assistant, 70% of whose salary is repaid by a family doctor funding scheme (FPC).

Each patient is given a unique code, so the computer can extract the patient's unique ID (identity) for the practice, his age and his sex. This code is written on the outside of the brown envelope the doctor keeps for each patient's records. When the appointment slip for the surgery session is drawn up by the receptionist, and the envelopes have been fetched, the codes are copied into the relevant column – a procedure that has been found to take only a very short time. The doctor then commences surgery and, after seeing each patient, records the reason for the visit, either in his own words or in a 3 digit code. Any code which categorises patients visits into less than 1000 different labels could be used although for the sake of standardisation users are encouraged to stick to a code devised by the Royal College of General Practitioners. If the doctor prefers to write say diabetes instead of 91 then obviously an assistant has to convert it later. A wall chart and booklet could be used and common codes are swiftly learnt.

An average three doctor practice may have seen six hundred patients by the end of a week. For each of these patients the assistant enters the appropriate code as recorded on the appointment slips. Once entered the codes can be recorded for future use or analysed immediately. It has been found that cassette operation is reliable, cheap and adequate. A month's data for three doctors can easily be stored on a ten minute tape. Once the data is resident in an array it can easily be manipulated to form lists of patients for given diseases, age ranges, doctors etc. Any combination of ID, age, sex, disease, doctor can be used in theory and the extra programming needed to provide an extra function would not be great.

Four main options are provided as standard:

1 The top thirty diseases listed by disease in order of frequency with the number of patients seen by each doctor and the percentage it represents of his total workload in the given period.

2 Grand Totals same as above but every disease met [illegible] with a total at the bottom.

3 Age-Sex breakdown [illegible] analysis by age and sex.

4 This is the most powerful [illegible] and allows you to look closely at a [illegible] disease. For [illegible] can be seen easily whether Mrs Smith is diabetic [illegible] avoid [illegible] among [illegible] although she really [illegible] see any doctor in the practice. By having [illegible] results each month a comprehensive picture is built up. This [illegible] option can [illegible] store be used to keep [illegible] of [illegible] children received [illegible] which a doctor may [illegible] which child, how old the child was [illegible] sex of the child.

By adding more codes it would be simple to keep records of say asthmatics on Drug A, asthmatics on Drug B and asthmatics on a placebo (chalk & salt tablets used to balance the psychological effect of taking drugs in the control group). This information could show that the members of group A were twice as prone in winter to catching bronchitis as a complication compared to group B. When added to results in other practices the results become very important indeed.

If a doctor wants a monthly statement printed out he can send his cassette to a bureau service where at a nominal cost he can be provided with a neat report by return of post.

Yearly analysis can also be done. 12 tapes are sent to the bureau to be wound off onto disk and processed.

## Confidentiality

There has been much discussion recently and many fears expressed over confidentiality. Each doctor in a given practice is referred to by a letter only and all his patients have codes which relate only to that practice. Without the doctors own index of codes it would be quite impossible to locate a patient. The printouts and cassettes carry no identifying data markers. Obviously to prevent confusion doctors would be advised to label their cassettes on the outside.

If doctors want to they can choose to copy only the disease information onto a second cassette tape allowing them to send disease information to a central research institute rather than age, sex, patient ID etc.

Is there a moral to this? It is that a useful computer system can be as complex as you like internally but must be very simple to be widely used by people who find even pocket calculators a trial. Simplicity must be coupled with reliability. If you combine these things you are on your way to designing a product that will be widely used and cheap to maintain. Both these factors allow the product to be sold at an attractive price. ■

---

• The system discussed is a single program running on a 32K PET and cassette deck. Details can be obtained from MEDICOM 1-2 Hanover Street London W1 Tel 408-1611. Patrick Dixon is a director of the company.

ATOM • APPLE • CHALLENGER • PET • SHARP • SUPERBRAIN • TANDY • TECHNALOGICS

Chalkwell

Computer

Services

★ Academic games and educational simulations for teachers and industrial trainers

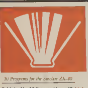
★ Business software for the catering and light engineering industries

★ Correspondence courses and video packages in microcomputer programming and techniques

★ Database and systems software development for micro mainframe networks and personal computers

72 RISE PARK, BASILDON, ESSEX

APL • BASIC • FORTH • PASCAL • APL • BASIC • FORTH • PASCAL • APL • BASIC • FORTH



*30 Programs for the Sinclair ZX-80*

Published by Melbourne House (Publishers) Ltd

I must make it clear immediately that I have come to this book as I believe the writers and indeed the makers of the ZX80 intended – that is, as someone who has no previous computer experience but knows that one should be interested in their continuing development, and probably uses their output in their work. What this means, then, is that if something has not been made clear in either this book or the Sinclair handbook I have not known how to get around the problem.

The book begins well with two neat programs "Leap Frog" and "Encoding". The first scores the number of moves it takes to switch two lots of four "frogs" from each end of a line with only nine positions. The second allows the user to code and decode messages using the random number generator. Both of these provide a lot of fun. However with the third program I hit my first problem, but more of that later.

What followed was like the "good news bad news" jokes. There would be one or two very good programs followed by the same number of apparently incomplete or badly written ones. I particularly liked "Lunar Landing", giving as it did the use of three variables to enable the pilot to land his space ship safely – this was a very infectious game. "Black jack" and "Pontoon" were interesting versions of the card games. Here the user sets out to beat the ZX80 and the winnings are accumulated by the machine and reported at each game's end. "Day of the week" allowed the user to input relevant birthday information and then produced the day of the week that it represented. "Maths Drill" allowed my six year old daughter to practise addition and subtraction by the use of large numbers created by the graphics in the machine. She was allowed three attempts before the ZX80 gave her the answer. These and several others were worth the sometimes tedious, programming (i.e. entering of the listing). "Draw a picture", however, was a disappointment as this works on a matrix basis with regard to the placing of the graphics but only one co-ordinate was called for and I did not know how to change lines.

My major criticism of the book is that it is not always made clear exactly what one should expect to see on the screen when the program is running. This was particularly annoying in the game called "Horse Race" which requires nearly sixty inputs. The race consists of four horses, running four lap races, and the player starts off with £100 betting money. Unfortunately, at the end of each lap the horses were all in line giving no indication of how the race was proceeding, which I felt, rather killed the point of such a game!

I was further irritated by the several programs which appeared to require more than 1K, despite being written specifically for that capacity machine. Three such programs happened to be consecutive – "Mazes", "Noughts and Crosses" and "Dr ZX80". In the first only part of the maze appeared on the screen and, if it had been complete, there was no indication as to how one would actually work through it. On "Noughts and Crosses" I completed all the inputs and pushed RUN and was greeted by an error code. I re-checked my inputs, pushed RUN and the same thing occurred. I decided to leave this program for the moment and continued with the next program "Dr ZX80" which appeared to be a very interesting exercise in talking with a computer. However the first set of inputs ends with the entering of 90 variables and I was only able to enter 82 of these when an error code stopped any further action.

However, on balance, I feel this book will be useful for those people who are starting out into the world of computers via the ZX80 as it offers a variety of programs which can be run and enjoyed prior to the user gaining his own programming expertise. ■

● **Adrian Butler** *is the Financial Controller for four European Subsidiaries of a U.S. electronics manufacturer*

---

**Basic Computer Science** **K. J. Atkins**

Pp's 257 Price - £2.75 Publisher Macdonald and Evans

This M & E Handbook on computer science is a good introduction to the subject ranging from a description of Boolean Algebra to the architecture of the Motorola 6800 and from RAM organisation to the working of a Barrel Printer. The handbook offers its reader quick exposure to a wide range of Computer Science concepts. The handbook is obviously not intended to go to any depth but it is a useful guide to any student of Computer Science and any computer professional who wishes to have a quick glance at the inner workings of a computer. The progress tests at the end of each chapter form a useful feature which helps to keep the reader on his toes. Finally it is perhaps worth mentioning that this handbook is not intended for either the specialist in Computer Science or the complete layman. If the latter were to pick it up by chance he would find it very hard going. A good buy. ■

● **Dan Remenyi** *is a management consultant*

*Lyn Farmer poses with an Ohio Scientific C24P at Microstyle*

# Paxton Business Desk

*[illegible] Richard Waller*

### New book-keepers start here

Ever since our predecessors first kept their records by making cuts in pieces of wood and splitting them down the middle there has been a need for controls. The Institute of Chartered Accountants has had checklists since double entry book-keeping began as have the other professional bodies. These checklists were upgraded and made more specific to data processing when Hollerith started to punch oblong holes into pieces of card board. These controls tended to concentrate on accuracy of input to the system so that you can be absolutely certain that everything that was supposed to be entered has been entered and entered right.

When files became larger the total number and value of transactions held on punched cards became critical. How would you know if you had dropped a few cards? Now we do not have cards but we do have several copies of the computer files because of new generations of data or because of back up copies. The controls are the same but the question is different: how do you know you have selected the *correct file* to process?

And now that business is more complex it is necessary to worry not only about the arithmetic accuracy of the data on the file but also about the possibility or even the probability that some of the items get miss posted. Who posted this item and when and why and where should it have gone?

With computers working so fast these controls became more automatic. Once the batch of data was into the system and agreed as correct then the routine file totals were reconciled by the system, the operator was only involved when disaster struck and the control imbalance showed a restart and rerun to be necessary. Micros do not normally have this level of control but the new packages do at least provide something to help the user.

Whatever the system be it manual magnetic stripe ledger card micro floppy disk Winchester file mini or main frame there are **ten rules** to follow.

These ten happen to be the ones I have specified but they are of course very similar to the checklists used by other accountants and consultants and set out in the books of accounting practice. No magic. Just a list to be ignored at your peril.

**The ten rules for control**

1 *Hard Copy Report*
Sufficient data must be printed out from day to day so that if the computer is for any reason not available the normal business of the organization can continue by [illegible]

a) Print and Transaction lists for manual posting
b) Customer and Supplier names and addresses
c) Current day book listings back to the previous agreed ledger balances
d) Copies of all ledgers usually on microfiche for archives and back reference

2. *Referencing*
Each item on computer files or printed on paper must be referenced back to the [illegible] document or record so that its source and accuracy may be checked.
Example a) Sales invoice numbers and dates
b) Purchase invoice date, vendor and a unique serial number
c) Cash Book date and serial number or cheque number
d) Batch references and dates

3 *[illegible]*
It must be possible to identify the person who entered each item of data
Example a) In a single user system [illegible] should record the [illegible]
b) In a multi user system the [illegible] should identify the [illegible] who entered [illegible] perhaps by batch reference [illegible]
c) In [illegible] hard copy [illegible] any change should [illegible] reference [illegible] computer [illegible]
d) [illegible]

4 [illegible]
It should be made as difficult as possible for a user to [illegible]
Example a) When [illegible] the code should be translated to its description and displayed for visual check
b) If an entry [illegible] that there [illegible] should be displayed [illegible] user
c) [illegible]
d) [illegible]

5 *Completeness of [illegible]*
It should be made as difficult as possible to miss out the processing of a transaction
Example a) Significant documents like Debit or Credit Notes, Invoices and Cheques should be pre-numbered, the number sequence checked and missing documents accounted for
b) Input documents should where possible be pre-sorted in batches of not more than say [illegible] documents, counted, pre-listed for a money or hash total and the count and totals agreed with the computer before the batch is accepted
c) Transactions entered individually should be assigned a date and serial number normally by the computer [illegible] entered and then [illegible]

[illegible]

c) [illegible] be checked [illegible] posted items [illegible] duplicates etc.

6 [illegible]
It must be possible to check that any calculation [illegible] has been done correctly
Example a) The factors in a calculation should be displayed or printed so that the calculation is capable of being checked and [illegible] manually
b) If the user has substituted his own [illegible] as a result of calculations there should be an indication on the output document and [illegible] that this has been done
[illegible]

7 *[illegible]*
There [illegible] that [illegible] the [illegible] file has been processed
[illegible]

When [illegible] the data s

passed from one [illegible] ar other the totals [illegible] should be capable of being [illegible] between the two programs involved

Note see also Section 10 Controls

8 *Back Up Files*

Enough copies of each computer file and the programs must be held to ensure that recovery is possible from any error or disaster

Example a) copies should be taken at least each day with printed transaction logs of every transaction maintained since the last copy for ease of recovery

b) additional copies should be taken after each significant transaction entry session before the material is processed

c) copies of data programs and manuals should also be maintained at another location to allow recovery after major disasters

d) the copy programs should include a verify procedure and in addition the copy should be used for further processing allowing the retention of the original unchanged

e) file copy programs should run fast enough to encourage frequent use

f) the computer maintenance contract should provide for loan equipment if required or an alternative computer identified and tested with both programs and data for use in case of extended non-serviceability

9 Security

The user should be able to decide the level of security he believes to be useful to his operation and have available the tools to help him achieve this

Example a) locked rooms in which the computer is located

b) key lock on the computer console

c) identification of users logged onto the computer files or on associated manual records

d) Passwords on significant programs files records or data items

e) A manual console log and fault book which identifies all errors and faults as they occur

10 Controls

In any financial application it must be possible for the user to check that the records are in balance and immediately to identify when there is danger that the records are not balanced

Example a) Control Accounts should be maintained for each application Sales Purchases Nominal etc and for subdivisions of large master files

b) Day Books should be maintained to provide transaction totals by type and to provide balanced against a computer produced running balance on the control account

c) The closing balances should be added on the computer and compared with the total of the control accounts normally at least weekly

d) The control account reconciliation should be printed out by the computer or maintained manually and filed in sequence showing consistency between the old closing and new opening balance

e) Reconciliations should be of the form

| | |
|---|---|
| Opening Balance | XX XX |
| Plus Debit (by type) | XX XX |
| etc | XX XX |
| TOTAL | XXX XX |
| | |
| Less Credits (by type) | XX XX |
| etc | XX XX |
| | |
| BALANCE | XXX XX |
| Actual Ledger total Balance | XXX XX |
| | |
| DIFFERENCE | X XX |

## New Computer Users Start Here

How do you know what your particular accounting package provides

Answer with great difficulty

Even if you read the manual with more care than most purchasers seem to bother with it is seldom specified for each program and file You have to dig And to ask searching questions of the supplier Each input should have its control Each file should be totalled even the transaction files and even if they only contain statistical information And each method of updating a file should have a control and be reconciled with the input

On smaller systems with restricted size of memory and small floppy disk files it is unlikely that the controls will be very sophisticated The bare minimum is to have total printed at the end of each run of the number of transactions hash total of quantities or value With this information a *manual* log can and should be maintained with columns for each transaction type into which the totals can be entered At the end of the day these totals are added across on a handheld calculator (or on the computer in direct mode) and then agreed back to the total of the computer file involved If it takes too long for the computer to add up the file each day then perhaps once a week will do once you have confidence in the system

The Paxton software does a lot better than this It has control accounts on the principal files which the system attempts to balance

## Paxton Computers Ltd

Paxton operate from St Neots in Cambridgeshire and can be contacted on Huntingdon (0480) 213765 The three partners are Jason Brown Gareth Jones and Keith Etell who are all ex ICL systems people from Stevenage They have been independent for two years and have completed a number of consultancy and software projects There are now six professional staff at St Neots who are available to discuss customer queries

This is a small company The bad news is that they do not have a vast industrial empire behind them providing finance The good news is that these men are committed to the success of the company and there is no impersonal financier to pull the plug out without regard to the customer It seems that in fact the Business Desk venture is adequately funded from the other paid work. Nevertheless it pays to look at the bad side just in case and again Paxton come out quite well

## The rules are

Firstly it must be a rugged system that can be installed without excessive systems or training commitment This it seems to be the manual is good and Paxton are sufficiently confident that they offer software maintenance at no extra cost for the life of the system You only need pay for any new features you wish to take up and if these new features require file changes they promise a conversion pack at a small extra cost On the existing software around nine users are currently installed and seem satisfied

Secondly the program code must be in a recognised language capable of being maintained by others The language used is CIS COBOL which certainly meets this criterion The source code is not generally distributed but can be made available to the other agents who are trained to sell the package of which there are now five This number can be expected to grow in parallel with the Equinox sales outlets for the IMS systems which seem to be going quite well In addition I understand that the software will be lodged with a *neutral third party* and made available to customers in case of need

Thirdly Outside hardware expertise and support must be available This is provided nationwide by DDT Maintenance and by the other Equinox agents

## Business Desk

Business Desk provides ● order entry ● invoicing ● stock accounting ● sales ledger ● purchase ledger ● nominal ledger ● trial balance It can be installed on existing customer systems in which case it would cost around £2400 But it is most likely to be sold packaged on a specially designed desk with an **Industrial Micro Systems** 5000 or 8000 processor Elbit visual display and a choice of matrix or daisy wheel printers with 132 character print line In this case it would cost between £8000 and £10 000 depending on the *disk capacity required* for the customer's ● transaction and ● master files

*Some neat graphs are provided to assist system sizing*

At the low end the IMS 5000 with three double sided 5¼ floppies would take 500 accounts and a combination of 2000 stock items or 2500 transactions

At the top end the IMS 8000 with three double sided 8 floppies takes 3000 accounts 4500 stock items and 3500 transactions

Being written in CIS COBOL the system is capable of being re-compiled to *any other* CIS COBOL supported system for example Cromemco C3 or **Z2H** PDP 11 or **BASE** This would be done by Paxton for a fee which would depend on the extra work necessary to support any new peripheral devices involved

The price is for use on a single micro and includes software maintenance (but not enhancement) for the life of the sys tem hardware maintenance for the first year giving a single point of contact for any initial troubles two days training with more at a set charge if desired and the excellent manual It is claimed that the screen formats are self-explanatory and require minimum reference to the documentation Delivery of the hardware can be as quick as six weeks but customising and personalising of the software could take longer than this

Part of the customising is on the output reports Four items of pre printed stationery are provided ● sales invoice ● credit note ● statement ● order acknowledgement Using the standard stationery the computer can print the customer name and address etc Or personalised stationery can be ordered specially for the company Other reports are designed to be on plain paper

## Scope of the System

The bald list of facilities quoted above needs to be evaluated in detail against your particular list of requirements Paxton are always pleased to discuss other features At the moment the package is still being extended When one of my clients looked at Business Desk recently everything extra he seemed to ask for could be provided at no extra cost off the shelf

*Order entry* can assign an order number if required and prints an acknowledgement despatch note and invoice Orders can be amended before the invoice is printed if the exact quantity cannot be defined before delivery Outstanding orders are listed by product or customer A matrix of discounts by product and customer class is maintained

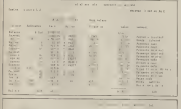
*Stock Accounting* deals with goods issued returned received and returned to suppliers There is a report of stock commitment and can inhibit issues of committed stock There are good stock turnover statistics showing units and sales value as well as cost Orders on suppliers are logged, and a minimum stock balance is noted

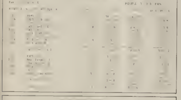
*Sales Ledger* is balance forward but with balances held for up to four or optionally six months back It is possible to select criteria for balances to be included in the aged debtors analysis list by amount, debit or credit or period outstanding There are listings for credit control and a stop list

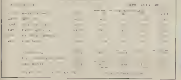
*Purchase Ledger* provides all the normal features The Creditors List helps management to select suppliers for payment cheques and remittance advices are prepared manually and keyed in

*Nominal Ledger* takes you up to trial balance VAT accounts are available Nominal accounts are held for cash and cheques paid and received for handling discounts and for sales and purchase control accounts On this last feature it is promised that these will be very similar to the format I have specified above

It is an integrated system But it is under proper control No postings are made until the complete batch is keyed in and balanced and the user has had a chance to get it perfectly right Then and only then does the system go away and post up all the accounts The Batch Size can be one item if you must But normally it will be 50 items in which case particularly on the slower 5 floppies it takes quite a long time As the salesman says you have time for a cup of coffee







## Summary

It all seems very good They seem to know what the business man requires and provide it very elegantly in one co ordinated package deal

Referring back to my original ten rules for control you may well ask whether the Business Desk obeys them all It seems to better than most But to give a complete sign off I should want to discuss with you your particular needs and charge you a small fee After all someone has to pay for my professional indemnity insurance ■

**Dealers**

Paxton Computers Ltd. Tel: Huntingdon 213785

Equinox Computer Systems Ltd Tel: 01-739 2387

Anglia Microsystems Tel: Ipswich 50750

Elmark Computer Services Ltd Tel. Hitchin 33277

Criterion Business Systems Ltd Tel 01-989 8177

● *Richard Waller is with Sphere and [illegible] Management Consultants*

# THAT FIRST COMPUTER
## Evaluating suppliers' proposals

*John Maclean after graduating in Mathematics from Lancaster University spent a number of years in the Aerospace industry before joining the National Computing Centre as a Senior Consultant. At the Centre he was involved in consultancy assignments mainly for first time computer users and in giving training courses. He is currently manager of Courses at NCC*

The previous article dealt with the preparation of a tender document to submit to suppliers. The preparation of this document will have or should have represented no small investment on your part in terms of time and effort. Similarly you have implicitly requested a major effort on the part of the suppliers in preparing their proposals and so it would be folly to throw this investment away and make a rash decision once you have received the proposals. Unfortunately the quantity and detail that you have been asked for in the proposals and that should have been provided by the suppliers can make the evaluation seem an impossible task, and so greatly increase the temptation to pick on one feature and decide quickly on the basis of that. Hence there is a need for *a formal evaluation procedure*

### How not to evaluate

As an example consider three competing proposals from suppliers A, B and C.

Supplier A is proposing a system which has fairly sophisticated software and thus is more expensive than supplier B's proposed system. However the VDUs (Visual Display Units) put forward by supplier A are inferior to those of supplier B on a number of counts but then supplier C has proposed VDUs which are by far the best of the three but unfortunately supplier C's printer is slower than A's and then etc.

As you can see with such uncontrolled methods of evaluation it is unlikely that a logical decision will ever be reached. Indeed you could go round in circles and end up by choosing simply the cheapest or the smallest – or even the nicest looking, surely no basis on which to select a system. Thus a formal evaluation procedure should be employed which will account for all the factors and features that will contribute to the decision, and it should at the same time reflect the differing nature and importance of these features.

### Costs

In any section of a computer system cost will be an important feature if not the most important. However although you may not have set a specific upper limit on the cost of your system you will almost certainly have a fairly good feel for just what you can afford and what sort of system you can expect for this figure. Thus if any proposal is well in excess of this figure it could be discarded at the outset since it does not satisfy a basic criterion. Also, any excessively cheap proposal should be viewed with scepticism. Although value for money has increased significantly in the last few years still the computer suppliers have not been noted for their cavalier philanthropy.

Whilst on the question of cost, also note that it is essential to consider *all* the elements of costs – both those of acquisition and those of the running of the system. Although necessary it may not be easy since suppliers may well provide their costs in differing ways and so you may have difficulty comparing like with like. Whether or not the system software cost is included in the hardware cost is a common example of the differing nature of cost proposals.

When considering the running costs of a computer system a period of five years is usually accepted as a reasonable timescale over which to assess them although with a significant investment involved a longer period may be hoped for.

A brief list of the *cost elements* could be as follows:

**costs**

**Acquisition**

Hardware –all items
Software –systems
–packages
–custom software
Training
Delivery
Implementation –especially file creation
Installation

**Running**

Possible software licence fees
Maintenance –hardware
–software
Consumables –paper
–printer ribbons
–storage media

### How to Evaluate

Having detailed the costs it is probably best to set them aside for a time and return to them once the proposed systems have been analysed in some detail. This analysis involves the formal procedure recommended earlier, which consists of the following steps:

- identification of the parameters/features to be assessed
- assigning a weighting to each parameter/feature
- for each proposal – scoring each parameter/feature
  - multiplying each score by its weighting factor
  - totalling all the weighted scores

This procedure is known as the **weighted ranking by levels**. It is in essence very straightforward but it should provide a quantitative assessment of all the proposals and also indicate where and why each proposal has done well or done badly.

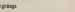
### Evaluation Parameters

The list of parameters/features to be assessed will consist of all those elements which you regard as important in your system and thus which contribute to the decision. The first step in listing those is to consider the computer system and thus the proposals, in three parts namely • hardware • software • support and • general features. In each of these categories you can then list the main features. For example in Hardware you may list CPU (central processing unit) discs, VDUs printer and expansion.

For each of these features you may want to consider *a further breakdown* so that DISCS may be split into ACCESS TIME and CAPACITY. Repeating this process for each feature in each of the three categories will produce a hierarchical list of all the features you may wish to consider split into levels. Thus at level 1 there will be the three main categories at level 2 the main features in each category and at level 3 the main elements in each feature.

It is obviously possible to go to much lower levels of detail but the risk is of taking unnecessary detail and so prolonging the exercise. *A typical business system will probably generate around 30 elements in the list.*

An extract from the overall list may look like the following



### Weightings

Having produced such a list you will then need to decide on the *relative importance* of each element on the list and reflect this importance with a numerical value or weighting. When doing this part of the evaluation and indeed the scoring, it may be useful to solicit the assistance of a computer specialist who can identify the relative importance of particular features and assess the suppliers offerings.

The allocation of weights starts at the highest level, i.e. HARDWARE, SOFTWARE and SUPPORT. At this level 100% is divided between the three to reflect their importance thus the weights may be HARDWARE – 40 SOFTWARE – 40% SUPPORT etc 20% You then take each of these in turn and divide 100% between the features in the category For example CPU – 25% DISCS 30% VDUs – 30% PRINTER 20% Then for each feature you divide 100% between the elements in that feature, e g within DISCS CAPACITY – 60% ACCESS TIME – 40%

To calculate the actual weight for each element you simply multiply up the percentages through each level Thus DISC CAPACITY would have a weight of 60% x 30% (DISCS) x 40% (HARDWARE) = 7 2 To ensure that this has been done correctly all the final weights should add up to 100%

### Scoring

With all the preparatory work now done you can actually assess the suppliers proposals This involves scoring each supplier s performance on each element A simple method is to take a scale of 0–10 where 0 = no value 5 = average and 10 = unsurpassable It is impossible, here, to go through each likely feature and suggest how the scoring may be undertaken and this is probably where you should use a *specialist* to help ou

One point to remember is that you should score the suppliers performance against *your requirements* and not against each other

Once you have scored each element for each supplier then multiply each score by the appropriate weighting and add up all the weighted scores for each proposal You will now have a numerical assessment of all the proposals and by looking over the individual scores be able to see where each was strongest and weakest

It is not at all uncommon to find two or even three suppliers with similar scores each having differing strengths but by taking account of the cost it should be possible to identify the best value for money

*'you should still be looking to the supplier to satisfy you on all outstanding points before any final decision.'*

One of the simplest ways of taking full account of costs is to take each system s score and derive a performance cost ratio by dividing the score by the cost in £1 000s (where the cost is the total over say 5 years) This will mean that you have a *score* a *cost* and the *ratio* on which to make your decision But as a result of the evaluation you will also have a list of questions that you wish to put to your suppliers[1]

Thus although there may be an outright winner you should still be looking to the supplier to satisfy you on all outstanding points before any final decision

If as is more likely there is still an uncertainty as between two suppliers then the answers to the questions should provide further evidence as should the three final elements to the decision namely supplier references supplier presentations and 'gut feeling

The following up of references is essential to ascertain the credibility of some of the suppliers claims especially those relating to support and reliability A presentation will give you the opportunity to ask the outstanding questions and may indeed prompt more It will also give you the chance to actually see a system working and possibly test-drive it (A note of caution a computer system operating in a presentation situation is not necessarily how it operates in practice since small files may be used and the printing may be only summary )

The element of gut feeling could cover such aspects as the supplier's professionalism attitude and commitment to your system Since you will be working closely with the chosen supplier, those factors would not be disregarded, and indeed could swing the decision if no clear winner has emerged so far

You should now be in a position to confidently pick your computer system and proceed to the final stage of acquiring your first computer – the implementation ■

AERCO
EST 1945
GEMSOFT

COMPUTER SERVICES
APPOINTED DEALERS FOR

APPLE SUPERBRAIN
VIDEO GENIE
MIDAS ANADEX

Aerco Gemsoft major in systems for small & medium sized businesses The best software packages available are stocked to support this service including Stock Control invoicing sales & purchase ledger, payroll accounts production and word processing

Specialist programs written for production control planning & engineering applications

If you require a micro computer at a competitive price supported with intelligent advice or a system with standard or special software Contact

**Aerco-Gemsoft Computer Services,**
**27, Chobham Road,**
**Woking,**
**Surrey GU21 1JD**
**Telephone Woking (04862) 22881**

The Key to the
'One Stop Shop for
Computer Supplies

We have a large range of products from disks to desks and safes to stationery Our "off the shelf" products comprise – Magnetic media listing paper D P binders printer ribbons & daisy wheels – in fact everything for the computer user!
Ask for our Price List

**★ ★ ★ THIS MONTH'S SPECIALS ★ ★ ★**

2 Part Statement Invoices £35 00 per thou
Diskette Head Cleaning Kits £19 50
( VAT)

**care computer services**

Suite 204 Crown House
Armley Road Leeds LS12 2EJ
Tel (0532) 450667

THE KEY TO THE ONE STOP SHOP IS IN YOUR HAND!
DIAL LEEDS 450667

# Grants And Consultancy

There are many reasons why computers are considered a difficult subject. A number of these reasons are to do with the type of publicity computers received when they were first announced. Names like the electronic brain were used to describe computers and these terms served to intimidate. The result of the intimidation was that a phenomenon developed called computerphobia which at its least harmful had the effect of encouraging managers to stay as far away as possible from computers. But all of that electronic brain stuff was between 20 and 30 years ago. Today we know better than to be intimidated by dumb electronics — or do we?

It seems not! Despite the considerable efforts of the Department of Industry to encourage the use of microprocessors in British manufacturing industry their use has not spread as quickly as one would have imagined. Thus the Department of Industry has changed the scheme to provide even greater assistance to those who might have some interest in using microprocessors or microcomputers. Previously a manufacturing firm was eligible for a grant from the government to finance consultants to do a feasibility study which investigated the use of microelectronics in new or enhanced products, or a study which investigated the use of microelectronics in production machinery. But under this scheme money was not available to look at data processing feasibility related to production. This has recently been changed.

*'Packages for Invoicing and Stock Control always seem to require customising.'*

It is now possible to obtain a grant of 50% of the consultant's fees (up to a maximum of £1000) to pay for a feasibility study which will investigate a wider range of applications than the very narrow definition of products and production used before.

The new application areas still have to be related to improving the production function. It will only be by usage that we will see how Warren Springe interprets the new rules. In addition to the 50% grants another scheme has been announced whereby a short consultancy visit will be paid for by the Department of Industry. The grant for the short consultancy visit is £350 and given the present cost of consultancy this could represent no more than a one day visit to the client followed up by a fairly cursory report.

So what do these two new developments really mean? In a sense they are like the classic story of good news and bad news. The good news is that more encouragement is available from the government and the bad news is that British manufacturing industry still needs this type of encouragement. With so many microprocessor/microcomputer success stories about, it is surprising that government grants are necessary to encourage industry to take advantage of the new technology.

So in analysing the situation we can only conclude that computerphobia is in fact deeper rooted than was originally believed and that it will take a massive amount of encouragement for managers to move into the computer age.

To be completely specific, what could a consultant do for you in a few days to improve paperwork in your factory?

Firstly, in any business Sales Ledger and Sales Statistics, Purchase Ledger, Nominal Ledger up to Trial Balance, Stock Accounting and payroll are not difficult to implement. A day's consultancy would enable you to identify whether this approach is viable at a system cost of less than £10 000 installed.

Packages for Invoicing and Stock Control always seem to require customising. Machine Scheduling and Cost Estimating should be possible to program at low budget prices. In these cases two or three days work should produce a short specification of what is required as a basis of discussion for cost justification. Installed cost? About £15 000.

To do more than this it is worthwhile looking at a budget in excess of £30 000 installed. There are a number of excellent systems houses who can help you. Is this approach justified? That is the question that a short study of two to three days could help you decide.

Why go to consultants? Because consultants have no axe to grind and can look impartially over the whole range of systems and prices. With the facts thus discussed with you, a detailed investigation with a small number of suppliers becomes realistic. ■

BIM MCL

3rd Study Tour U.S.A.

NEW YORK
and
SILICON VALLEY EAST
(Boston Mass)

Microprocessors
in Action

Advanced Information Technology

A five working-day intensive
study tour of computer
manufacturers and users on the
East Coast of the U.S.A.

DATES
Departure Saturday 21 February 1981
Return Saturday 28 February 1981

Further tours are available in spring and summer
Enquiries should be addressed to
Conference Department
British Institute of Management
Management House Parker Street London WC2
Telephone 01-405 3456

BIM MCL

Getting to grips
with
Mini and
Micro-Computers

A BIM MCL two-day intensive course offers new understanding and skills for all managers, accountants and businessmen.
The course provides a thorough understanding of the nature and potential uses of the new generation of small computers.
Micro computers are used to explain and demonstrate, and to coach participants in writing their own programmes.
Dates

19–20 February 1981
5–6 Mar 1981
15–16 Apr 1981

Management House Parker Street
London WC2
For full descriptive brochure
information and bookings telephone
BIM Conference Services 01-405 3456

**Lynda King Taylor**

# OVERSKILL AND SHORTFALL

*When a man says he approves of something in principle, it means he hasn't the slightest intention of putting it into practice.*
Prince Otto von Bismarck—
(1815-1898)

I remember at school being told that politics offered yesterday's answers to today's problems.

This came back to me recently during a discussion with colleagues at the Manpower Services Commission (MSC) regarding the lack of skilled computer personnel in the UK. Early in 1980 the Institute of Manpower Studies estimated that in Britain we were short of at least [illegible] skilled software personnel, particularly programmers. This figure underlines the significant undertraining in computer occupations. Supporting evidence in the form of studies of local labour markets by the Department of Employment (DOE) and the MSC indicates that over the past few years there has been a skill famine unlikely to be alleviated by existing training facilities.

For example, last year in an MSC labour study of the manufacturing sector in South Yorkshire about half the firms questioned felt that present arrangements would not meet future demands for skilled computer manpower, while a similar MSC study of engineering firms in Portsmouth found that 40 per cent of the companies considered their training facilities were not enough to meet expected demands for microelectronic skills.

Similar results appeared in studies in Reading, England, West Fife and the central region of Scotland. Yet I hear from various civil servants that politicians have known this for years. When politicians, echoing and vindicating Bismarck, say in principle they will do something they haven't the slightest intention of putting it into practice, and when they do it is too often yesterday's answer to today's problem — too little too late.

The shortfall discovered by the Institute of Manpower Studies indicates not just the paucity of resources now but also what it is likely to be. In spite of the recession everyone agrees that the shortages are likely to increase, particularly with systems analysts and design engineers.

The MSC is helping through a variety of grants and educational courses, but even they admit that this is not enough or ever could be without more onus on employers themselves to offer basic training in computer skills.

According to John Hyatt of the MSC the main reason for the shortage lies with employers as they do not train their existing manpower, preferring to buy in experienced computer skills rather than offer basic training. In this accelerating market many employers cannot see their investment in training paying off and would much prefer to receive their personnel gift wrapped in skills learned at the expense of others.

In computer departments today companies still demand graduates. Their rationale is that we are not hiring programmers but top managers. Maintaining a programme is boring, just like assembly line checking. Taking a cursory sample of various companies I discovered that over 30 out of 40 required degree personnel for programming. could they find enough? no (some blue chip companies were as much as 30% short!) why did they need graduate personnel? we are a growing concern or hope to be and today's programmers are tomorrow's technical experts etc. etc.

## Overskill

Over-recruiting into a job does wonders for the motivation of the hirer but frustrates the hired into apathy or into submergence in labour turnover statistics.

Then the professional, he feels, is beckoned by the highest bidder. And each bidding company hopes money will buy commitment. It seldom does. The high turnover in turn drives up the reluctance amongst companies to train key personnel. A job has to be done and everyone knows where to find the right guy with the skill and is prepared to pay for it, but not to instil it through training.

Take, as an example, an MSC educational programme, the THRESHOLD scheme, which encourages young people to enter the computer world. The THRESHOLD MSC-sponsored course has been in operation since 1976; it is designed to help unemployed people aged 16 to 19 who are attracted to data processing.

The National Computing Centre (NCC) administers the scheme on behalf of the MSC, which pays the fees and an allowance to the students, which (from September 1980) is £26 per week. The NCC, local education authorities and the MSC assist students to find jobs at the end of their 42 weeks sandwich course.

THRESHOLD students spend about 18 weeks of their 42 week course in college, the rest on what is known as placement with employers. Many of the students are subsequently offered jobs by their placement employers. In [illegible] 220 students gained NCC THRESHOLD certificates and in 1980-81 more than [illegible] are hoping to gain the NCC qualification at one of the 60 colleges operating the scheme in the UK.

One trainee, Colin Avery, left school in the summer of 1978 with a handful of CSEs and a couple of O levels, wanting to be a computer programmer.

He started the THRESHOLD course last September after seeing an advertisement in a newspaper. He said he left school knowing he wanted to be a programmer but for that he would have needed 2 A levels, so he applied to do the THRESHOLD course, passed the aptitude test, and if it had not been for the scheme he would have had no chance of becoming a programmer. He is now working as a programmer and is luckier than some of his other colleagues on similar THRESHOLD courses.

Colleges are now finding it difficult to place their students. However, colleagues at the MSC confided that it was not just the recession, for there still are shortages of programmers and operators. It was more to do with snobbery. Companies wanted computer staff with degrees in science or technical subjects. This emphasis on qualifications appears to harden employers' prejudices in favour of the graduate rather than of the NCC THRESHOLDER.

When I raised this point with the personnel manager in the blue chip company with a shortage of programmers, he first denied knowledge of the THRESHOLD scheme, then declared that a person with three O levels, a 42 weeks course and probably long hair was not for them. It is this grandeur that the MSC are up against when hoping not just that employers will cultivate the THRESHOLD scheme but will actively encourage in-house training. So the MSC is increasing and [illegible] its range of help, particularly through its grants programme.

## The Grants Programme

The grants programme is geared towards those companies and employers short of computer skilled staff, and from last September the MSC has increased the help it offers to employers who are prepared themselves to provide training in computer programming and systems analysis for their employees on specified courses.

The MSC grant support programme is part of an £11 million JOINT COMPUTER OCCUPATIONS programme phased over three years aimed at stimulating employers to train staff to certain standards of skills.

The MSC offers six courses that attract grant support, ranging from basic programming for new entrants lasting 42 weeks to shorter courses of up to 24

[illegible]

The MSC will [illegible] +1500 per trainee [illegible] programme [illegible] to employers per trainee [illegible] programmers [illegible] time programmers and [illegible] analysis training [illegible]

The type of grant [illegible] does [illegible] employers [illegible] computer skills training [illegible] John Hyatt who is responsible [illegible] the programme [illegible] is in no position [illegible] wrapped skills to the [illegible] some effort from the employer [illegible]

The scheme is still new [illegible] to my random sample of [illegible] computer personnel I find th[illegible] 40 companies approached [illegible] aware of the new incentives [illegible] tacted the MSC for further [illegible] a further five who knew of the MSC grants programme said they [illegible] prove the specified MSC courses which are basically [illegible] City & Guilds [illegible] London Institute [illegible] colleges of further education and at polytechnics. Such courses [illegible] to today's problems but not to tomorrow's [illegible] this comment came from the company with the 30 shortage of programmers.

I personally think the MSC programme would be of enormous value to smaller and middle sized companies who are prepared to provide training for their key personnel in computer skills. For them the costs of ruthless poaching are becoming prohibitive. But some smaller companies I have talked with are in a [illegible] about training, because of the [illegible] of many computer personnel themselves. Once trained they move callously on to the highest bidder. The Civil Service is [illegible] better off at estimates a 30 [illegible] in its computer manpower.

The impact and implications of all this on the market place are difficult to assess. The MSC JOINT COMPUTER OCCUPATIONS programme is nowhere near intensive enough to solve the shortage even with the addition of TOPS to the THRESHOLD and the grants scheme.

## TOPS

The TOPS (Training Opportunities Scheme) scheme is for people who want to brighten their prospects and aims to provide industry and commerce with people who are relevantly trained. Run by the Training Services Division (TSD) of the [illegible] year [illegible] a training [illegible] must [illegible] away from [illegible] period [illegible] intend [illegible] using the skill the[illegible]

[illegible] all almost have [illegible] and 1980-81 The [illegible] TOPS support [illegible] 30 [illegible] technicians training [illegible]

The MSC [illegible] to provide some 4000 training places for computer software occupations during 1980–81 which will be funded from the £11 million budget for the JOINT COMPUTER OCCUPATIONS programme. This is expensive for apart from the TOPS allowance to students almost £30 per trainee week minimum the MSC has to pay their college fees these average £120 to £130 per week.

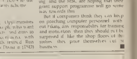
Most of the company staff I talked with in my sample said they would like to see TOPS extended say from 4000 training places per year to 8000. Employers need to change their attitudes towards training and the MSC are hoping that their grant support programme will go some way towards this.

But if companies think they can keep on poaching computer personnel without taking any responsibility for training and motivation then they should not be surprised if like the shop floors of the sixties they price themselves out of business. ■

INCOMPLETE RECOROS ACCOUNTING tm with a PET COMPUTER

[illegible]
AUTOMATIC DOUBLE ENTRY
TRIAL BALANCE
NOMINAL LEDGER
TRADING PROFIT & LOSS
BALANCE SHEETS
for Limited Companies
Sole Traders Partnerships

from
£625 or £3 25 per week



Complete System Including

[illegible] £ 625 or £ 3 25 per week
[illegible] £1 350 or £ 7 02 per week
[illegible] £2 470 or £12 85 per week

Professional programs also available for Payroll Sales & Purchase ledgers Stock control Business Information Building specifications Word processing

Continuous stationery 2000 sheets [illegible] inches wide £14 00
includes VAT and postage & packing

MICRO COMPUTATION
9 Station Parade
Southgate London N14 Telephone 01-882 5104

Write off your Computer Supplies problem now.

Flexible Disks
Digital Cassettes
Printwheels
Binders
Disk & Tape Storage
Magnetic Tape
Cartridges
Ribbons
Continuous Stationery
Filing Systems
Fire Resistant Cabinets
Diskpacks

Please send me your latest catalogue.
Name
Company
Address

CA/2

WILLIS
Computer Supplies
for people who know better

Post to: Willis Computer Supplies Limited P.O. Box 10 Southmill Road Bishops Stortford Herts CM23 3DN Tel: Bishops Stortford (0279) 506491

# See how solid our backing is.

**Issue 1**
Clive Jenkins and the [illegible] chess playing programs intelligent [illegible] and the layman. Micro[illegible] Algorithmic designs. How mighty [illegible] super sales. Why not a computer [illegible] ness? Some micro computer [illegible] Learning FORTH. Office [illegible] The future [illegible] much more

**Issue 2**
The government's views on computers. Solar energy and the personal computer. Tribute to Christopher Evans. Microcomputers in the legal professions. Accountants guide to microcomputers. The peripheral connection. Towards artificial intelligence. Why not a computer in your home? Brand news and much more

**Issue 3**
Faceless bureaucrats [illegible]? Buying a personal computer. Saving energy on a micro. Doing it in binary. The small business market hots up. Book reviews. When we are older. Database. The modular approach. Optimising employment.

**Issue 4**
Corporate responsibility. Desert island floppy discs. Microcomputers in the classroom. Write it yourself. Computer retailing dissected. Using a digital [illegible]. Keeping your computer happy. Computers and everyday language. Topics in artificial intelligence. Computers to the smaller firm. Letters

**Issue 5**
Communication for the disabled. This is ITMA. The micro alternative interface. Computers for the smaller firm: implementing the functions. Activities and interrupts. Hardware, software and knowwhere. Small systems for business. Database. The great structure debate. Letter from America

**Issue 6**
Educating the micro for classroom use. Technology marches on — but where? A fresh look at the American scene. Computer-generated evidence. Policy decisions and the new technology. Educational data bases. Computer lighting for the small theatre. Topics in artificial intelligence: computers and speech. Technology for what?

**Issue 7**
Computer crime. British microprocessors. Computer wellness. Understanding natural language. Management cybernetics. The government and technological change. Access to money. Systems for business. Small scale business computing. Structure and computer based learning. Putting it together. The missing links.

**Issue 8**
Distributed processing. British machine speaks for the dumb. To scale [illegible] New technology and management. [illegible] Conversational [illegible] Neurological intensive [illegible] and his computer. Book review. The [illegible] processors. Un[illegible] a micro revolution

**Issue 9**
The micro [illegible] New technologies to [illegible] language. The helmsman [illegible] Office organisation. An integrated accounting system

**Issue 10**
Chips here and there [illegible] mighty meet. The Open University. Are computers alive? Making your programs readable [illegible] language. Handling data. The British Institute of Management. CAP CPP Mu[illegible]

**Issue 11**
The handicapped. Setting up a microcentre. Robots in industry. M[illegible] data base management. The psychology of programming. The computer and copyright protection. Software review. Systems for business

**Issue 12**
Questions and answers. Letter from America. Assemble tutorial. Robots and the factory of the future. Handling data. The future of law and lawyers. Insurance. Word processing. Brand News. Pascal 2

## Each back issue costs 60p

*(including postage and packing)*

**Write to: Computer Age**
**4 Valentine Place London S.E.1.**

## DON'T MISS OUT ON THE

## Computer Age

*Computer Age* has rapidly become the magazine people both read and use as a reference. We have set the pattern from the first issue and are making it even more attractive to people like you who have an interest in the computer scene.

So if you have enjoyed this issue, why not guarantee your copy each month (before the magazine reaches the shops) by taking out a subscription? Twelve issues will cost you just £7.20. (We'll take care of postage and packing costs.) Seems a small cost for keeping in touch with the significant applications in the constantly changing computer age.

**Note** If you wish to keep this page intact, please send a photocopy of the coupon on a separate letter instead.

I wish to take out a subscription to *Computer Age*. Please forward the magazine each month starting from issue ( )

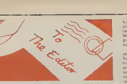
Name

Address

Signature

I enclose a cheque/postal order for £7.20 (Please make payable to *Computer Age Limited, 4 Valentine Place, London, S.E.1.*)

☐ TICK HERE FOR YOUR FREE TAPE
[illegible] See page [illegible]



## The Helmsman

As a Chemical Engineer working in the Marketing sphere of Industry I was very interested in the recent series of articles by Mr M Saeed Sheikh on Management Cybernetics (Issues 7 to 11). It is my considered opinion that these articles should be required reading for all those whose daily task is the establishment of marketing strategies within the confines of available production resources.

Mr Sheikh has introduced the Cybernetics concept to many people in a clear and easily digestible manner and I trust that I am not alone in hoping that he may return to this subject in future articles to further enlighten us.

**Alan D Perkin B Sc(Hons) Eng in Chem. Eng C Eng M I Chem E 67 Wynchgate Southgate London N14 6RH**

## Turn up the volume control

Martin Banks' recent article (Issue 12) in which he proclaimed that the microcomputer vendor was being put in jeopardy by the high mark ups required by the manufacturer seems to me to put the cart before the horse. Furthermore it would indeed be racketeering if the margins suggested by Martin Banks were correct but to follow his suggestion of giving more to the retailer will really make very little difference in the long run.

If we are to have the long awaited and much written about microcomputer revolution then the cost of microcomputers to the end user has to fall even further. It is the cost in the end user's hands that is the only important factor in the equation. Micros such as the Pet at £300 together with a corresponding price decrease in disk drives and printers would put a word processor in every office in the land and this is not to mention the untold opportunities for computing per se.

With the sort of volume which would be generated at this price level the industry could support many more healthy dealers than it can at the moment. And of course the manufacturers would also find this situation a lot more lucrative. Experience even if Mr Banks suggested margins are unrealistic.

**Dan Remenyi The Management Centre Ltd First Floor South Bretenham House, Lancaster Place London WC2E 7EN**

## Compulsive reading

At the moment I am on an N C C Threshold Course at Wakefield Technical College and I feel I must write to congratulate you on being the best magazine currently on sale.

I started to buy Computer Age two months ago and my knowledge of the computer world has increased twofold.

I found the following both interesting and useful in the December issue:

1) Transferring CP/M Files
2) Bubble memory
3) North Star at Vinyl Island
4) Microcomputer payroll

May I take this opportunity to thank you for your superb magazine and I hope you go on for many years to come.

**Mark Dyball 48 Canal Lane Lofthouse Gate Wakefield WF3 3HT**

**Editor's note** *Thank you. Will readers please write in and give their (short) assessments of articles.*
- Copy of Martin Banks' Living With The Micro

## Perfect presentability

Having just read the article Micro Voices in Computer Age (Issue 1 ) I am writing to you to find out more about the T I LSI chip featured in the article (TMS 5200). Although I don't expect you to supply this information yourself I was hoping that you could supply me with the name and address of someone who could. I am particularly interested in the technical specification.

I would also like to take this opportunity to congratulate you on editing the best Micro magazine in this country if not the world (certainly the best one I have ever read). I find that the majority of micro magazines available are designed to cater for a very narrow band of interest ie I have an XYZ computer how do I make it do something that looks good type approach with only the occasional and usually superficial venture into more serious uses of micro electronics. Your magazine on the other hand addresses a very wide range of subjects all well presented.

I wish you a happy anniversary for your next issue.

**Terry K Porter 1 Rocks Nest Cottages Weston Road Stevenage Herts**

## A student of discernment

I am a first year computer science student at [illegible] University of London. The concept of processes (being created, having their own environments etc) is played on quite heavily in our Programming Course and I was therefore attracted to Professor Lawson's article in your December issue. I would therefore like to approach the [illegible] Understanding Computer Systems. If you could get me complete syllabus of the course I would also be grateful for a reference for a good book on points about programs as other strong element of our course.

Incidentally I was recently inspired to write an essay on programming technique with the hope of submitting it to your magazine. However having seen the standard of some of your articles eg Understanding Computer Systems, The Unix operating system (which I use) and Distributed Computing all in the same issue I think I'll wait till after I've graduated!

**(Name and address withheld)**

- **Editor's note** *The writer's name (and the name of his college) have been withheld to protect him from his own modesty. It is hoped that the Ed[illegible] reader [illegible] as sign his feelings of anonymity.*

## Ten thousand recurses!

Would you or your readers care to comment on the following simplified segment of a main program?

```
[illegible]
```

A visual comparison by printing LINE 50 makes LINES 60 70 and 80 redundant but this is not the point: why does the program go to LINE 80 when C and D are in fact equal?

**A J Guy Beeston Seaside Lane, Eccles on Sea Norwich Norfolk, NR12 0SJ**

- *[illegible]*

```
[illegible]
```

## The inn club

If you have a section for User Groups or Computer Clubs could you please include in it a mention for Chorley Computer Club. Although owners of any type of computer (or even no computer) are welcomed the club has a PET bias. We meet informally on alternate Tuesdays in a pub in Chorley and visitors and new members are welcome. Contact Rod Wilson on Chorley 71875 or Chris Hicks on Chorley 78376 for more details.

**C Hicks 131 Market Street Chorley Lancashire**

IBM GOLFBALL PRINTERS
From £425.00 + VAT

Recond tioned printers with keyboard and RS232 interface

Sales — Service — Supplies

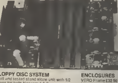
A.I.D. OFFICE PRODUCTS — SUPPLIES

Brindiwell Ltd 55/57 Brook Road
Frampton Cotterell Urmston
BRISTOL MANCHESTER
Tel (0454) 774664 Tel (061) 747 6454

# interface components

## NASCOM SYSTEMS & PERIPHERALS

### 'SUPERMUM' COMBINED MOTHER/BUFFER/PSU BOARD



A 12 × 8 piggy back board for the Nascom 1. It contains a five slot motherboard, quality 5A power supply and reliable buffering with reset jump. The board facilitates easy floppy disk expansion

**£85**
+ £2.50 P&P + VAT

### FLOPPY DISC SYSTEM

Built and tested stand alone unit with 1/2 drives for both Nascom 1 & 2

| | |
|---|---|
| Single drive CP/M (160K) | £450 + £4 P&P + VAT |
| Double drive CP/M (320K) | £640 + £4 P&P + VAT |
| Single drive D-DOS system (enables existing NAS-Sys software to be used) | £385 + £4 P&P + VAT |
| Spare drive | £205 + £2 P&P + VAT |

Verbatim Diskettes £3.75 + VAT each
10 for £32 + VAT

Nascom 1 owners: Add £10 + VAT to prices above for Reset Jump Kit

**NASCOM 1 kit £125** + £1.50 P&P + VAT
**NASCOM 1 built £140** + £1.50 P&P + VAT

### SPECIAL INTERFACE OFFER NASCOM 2 WITH 16K RAM BOARD BUILT £345 KIT £295 (+ £2 P&P + VAT)

### NASCOM IMP PLAIN PAPER PRINTER £325 + £2.75 P&P + VAT

### RAM BOARDS—SPECIAL PRICES

16K RAM £90 + £1 P&P + VAT
32K RAM £110 + £1 P&P + VAT
48K RAM £130 + £1 P&P + VAT
64K RAM £150 + £1 P&P + VAT

### SOFTWARE ON TAPE

BASIC Programmers Aid £13 + VAT
8K BASIC £15 + VAT
ZEAP 2 £30 + VAT

### ENCLOSURES

VERO Frame £32.50 + £2 P&P + VAT
Microtype M3 Case £24.50 + £2 P&P + VAT
Kenilworth Case £49.50 + £5 P&P + VAT
2 card support kit £7.50 + VAT
5 card support kit £9.50 + VAT

### PERIPHERALS

3 Amp PSU £32.50 + £1.50 + P&P + VAT
Motherboard £5.50 + VAT
Mini Motherboard £2.50 + VAT
VERO DIP Board £12.50 + VAT
I/O Board £45 + £1 P&P + VAT
Buffer Board £32.50 + VAT
EPROM Board kit £65, built £70 + £1 P&P + VAT
A D Converter £49.50 + VAT
Dual Monitor Board £6.50 + VAT
EPROM Programmer £25.85 + VAT
Castle Interface £17.50 + VAT
Port Probe £17.50 + VAT

### FIRMWARE IN EPROM

IMP PRINT £30 + VAT
NASPEN £30 + VAT
ZEAP 2 £50 + VAT
NAS SYS 1 £25 + VAT
NAS DIS £37.50 + VAT
NAS DEBUG £15 + VAT
NAS-SYS 3 £40 + VAT
Programmers Aid £28 + VAT

## SHARP MZ-80K + Peripherals

Bi Directional Serial Board £99.50 + VAT
MZ80FD (twin floppies 208K) £675 + £5 P&P + VAT
MZ80P3 Printer £425 + £5 P&P + VAT
MZ80 I/O Interface £89 + £2 P&P + VAT
CP/M 2.2 £200 + VAT
**Stock Control Sales/Purchase Ledger** and other business software and games in stock. Full list available on request

### SPECIAL INTERFACE OFFER 48K MZ-80K System £460

+ £10 carriage + VAT

## SHARP PC-1211 POCKET COMPUTER

The PC-1211 uses BASIC and has up to 1424 program steps, 80 character input line with full editing facilities, 18 user definable keys, 24 character alpha numeric LCD display. Optional cassette interface is available. PC-1211 is battery operated, has auto power off function and maintains all programs and data in its memory even after the power has been turned off

**Cassette Interface**
£13 + VAT

**£86.92**
+ £1 P&P + VAT

## CENTRONICS MICRO PRINTERS

**High performance — Low cost**

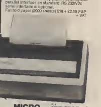
**737—£425 + £3 P&P + VAT**

737 Dot Matrix Printer runs at 80cps (proportional) or 50cps (monospaced) giving text processing quality print. This new printer is capable of printing subscripts and superscripts

**730—£375 + £3 P&P + VAT**

730 Dot Matrix Printer can print 10cpi or 16.5cpi at 100cps and 165cps respectively

Both printers have 3-way paper handling and parallel interface as standard. RS 232/V24 serial interface is optional.
Fanfold paper (2000 sheets) £18 + £2.50 P&P + VAT



## MICRO MART

**Voltage Regulators**
**T0220 1 amp**

| | |
|---|---|
| +5, +12, +15, +24V | 80p + VAT |
| −5, −12, −15, −24V | 80p + VAT |

**T03**

| | |
|---|---|
| 1A + 5V LM309K | 50p + VAT |
| 3A + 5V LM323K | £3.90 + VAT |
| 5A ± 5V 78H05 | £5.50 + VAT |

**ICs**

| | |
|---|---|
| EPROMs 2708 | £4.50 + VAT |
| EPROMs 2716 | £7.50 + VAT |

**Memories**

| | |
|---|---|
| 21L02 | £0.80 + VAT |
| 4027 | £3.70 + VAT |
| 4116 | £2.80 + VAT |
| 4118 | £7.50 + VAT |
| 2114 | £3.00 + VAT |

**Z80 Devices (4MHz 'A' version)**

| | |
|---|---|
| MK3880 | £8.90 + VAT |
| MK3881(PIO) | £5.00 + VAT |
| MK3882(CTC) | £5.00 + VAT |

Also extensive range of standard and LS TTL, CMOS and linear ICs plus other semiconductors in stock. Send for list

Unless stated otherwise add 50p P&P to all orders.
Prices correct at time of going to press.
New Interface catalogue now available on request
Access and Barclaycard accepted

**INTERFACE COMPONENTS LTD.**
**OAKFIELD CORNER, SYCAMORE ROAD, AMERSHAM, BUCKS HP6 6SU**
**TELEPHONE: 02403 22307. TELEX 837788**

# Guide to Advertisers

**ABIES INFORMATICS** 65
**MICKIE** [illegible] London

**ACORN COMPUTERS** 24
**ACORN ATOM** [illegible] **GRAPHICS 6502 CPU** [illegible] assembler Card [illegible]

**ALAN PEARMAN LIMITED** 47
**APL** [illegible] **APPLE** **SUPERBRAIN** **MAPLE** [illegible] Basis Manuals [illegible]

**ARGUA COMPUTER CENTRE** 15
[illegible] **ACORN** **APPLE** [illegible] **HORIZON** **NASCOM** **SHARP** **TRS80** **TANGERINE**, **UK101** **VIDEO GENIE** [illegible]

**BFI ELECTRONICS LTD** 6
**VERBATIM** [illegible]

**BEAVER SYSTEMS LTD** 66
**OHIO SCIENTIFIC** [illegible]

**BYTE SHOP COMPUTERLAND** 62
Computer [illegible] Manchester [illegible]

**CALCO SOFTWARE** 34
**PET** [illegible]

**CARE COMPUTER SERVICES** 73
[illegible] Leeds

**CHALKWELL COMPUTER SERVICES** 67
[illegible] **SHARP MZ-80K** [illegible] **APPLE/ITT 2020** **PET** **SHARP** **SUPERBOARD** **TANDY** [illegible]

**CODIRED COMPUTER SYSTEMS** 51
[illegible] **Z80** based system [illegible] **CP/M** [illegible] Business Software [illegible] **RAI** [illegible]

**COMART** IBC
**NEW** [illegible] **COMART CP100 COMMUNICATOR** [illegible] **CP/M** [illegible] operating system [illegible] **HORIZON**, **CROMEMCO** **CAP** [illegible] dealers

**COMMODORE** 2
**PET** [illegible] **DEALERS** [illegible]

**EMG MICROCOMPUTERS LTD** 34
[illegible] by **SORCERER** [illegible]

**EQUINOX** 10
**HORIZON** **EQUINOX 300** [illegible] **IMS** [illegible] operating systems [illegible] London

**GEMSOFT (AERCO-GEMSOFT)** 73
Specialists in Business Computers [illegible] software [illegible] **VIDEO GENIE** **APPLE II** **INTERTEC SUPERBRAIN** [illegible] **VDUs** [illegible]

**GEVEKE** 1
New **DIABLO 630** [illegible] **OEMs** [illegible]

**GRAFFCOM SYSTEMS GROUP** 24
[illegible] business [illegible] Systems [illegible] **ALTAIR** **ALTOS** **CROMEMCO** **DYNABYTE** **HEATH** **IMS 5000/8000** **MICROMATION** **NORTH STAR HORIZON**, **SUPERBRAIN** [illegible]

**GRAMA WINTER** 61
[illegible] **INDUSTRIAL MICRO SYSTEMS** **SUPERBRAIN** **SWTPC** **PET** [illegible] Terminals [illegible] London

**HAL COMPUTERS LTD** 18
[illegible] **CROMEMCO** **NORTH STAR HORIZON** **OHIO SCIENTIFIC** **SWTP** **SUPERBRAIN** **TRS80** **ZENITH** MICROTEK [illegible]

**A J HARDING (MOLIMERX)** 6
**TRS 80** [illegible]

**INTERAM** OBC/30
Business [illegible] **NORTH STAR HORIZON** [illegible] **WORDSTAR** **STOCK CONTROL** [illegible]

**INTERFACE COMPONENTS** 79
**NASCOM 1**, **NASCOM 2** [illegible] **IMP** [illegible] **SHARP** [illegible] **MZ 80K** [illegible] **SHARP PC 1211** [illegible]

**JAEMMA LTD** 34
Complete system [illegible] **SUPERBRAIN** [illegible] **QUME** **PAPER TIGER** [illegible]

**LANDSLER SOFTWARE** 55
[illegible] **PET** [illegible] **PET** [illegible]

**LOGITEK** 
[illegible] **ALTOS** [illegible]

**M i b F** 47
[illegible] **WANG** [illegible]

**MELBOURNE HOUSE PUBLISHERS** 80
New book: 30 programs for the **SINCLAIR ZX80 (1K)** London

**MICRO CENTRE** IFC
[illegible] **CROMEMCO** [illegible]

**MICRO COMPUTATION** 78
**PET** [illegible] London

**MICROPEOPLE** 12
[illegible] **SUPERBRAIN** and [illegible] **CP/M** [illegible] **APL** **FORTH** **PL 1** [illegible]

**NORTHAMBER LTD** 27
[illegible] **NEC** [illegible] **ANACOM 150** [illegible] **SHIBATA** [illegible] **QUME** [illegible]

**PERSONAL COMPUTERS LTD** 39
Long established [illegible] **APPLE** [illegible] **APPLE** [illegible] **VISICALC** [illegible] London

**PRAGMA LTD** 54
**PRINTRONIX** [illegible]

**Q TEK SYSTEMS LTD** 47
**VIDEO GENIE** [illegible]

**SCIENCE OF CAMBRIDGE** 40/41
[illegible] **SINCLAIR ZX80** [illegible]

**SEMEL** 27
S100 [illegible]

**STEMMOS LTD** 34
**SUPERBRAIN** [illegible] **DIGITAL** [illegible] London

**STRUTT** 15
[illegible] **MEMORY** [illegible] **INDO CPU** [illegible] **EPROM** [illegible]

**SUN COMPUTING SERVICES** 42
[illegible] **SUPER BRAIN** [illegible]

**WILLIS COMPUTER SUPPLIES** 75
**CATALOGUE** [illegible]

**XITAN SYSTEMS LIMITED** 6
[illegible] **CROMEMCO** **NORTH STAR HORIZON** **PET** [illegible] **MEDI-DATA** [illegible]

FREE
details of independent advice and experience as well as discounts on a wide range of computer hardware, software supplies, etc. Send large SAE to
Dept CA
COMPUTER CLUB
42 Great Windmill Street
London W1V 7PA

**Comart Approved Dealers**

**Belfast**
U & M Systems
[illegible] Dublin Road
**Tel** 0232 41440

**Birmingham**
Byteshop Computerland [illegible]
94-96 Hurst St. B5 4TD
**Tel** 021 622 7149

**Cambridge**
Cambridge Computer [illegible]
[illegible] Emmanuel St. CB1 1NE
**Tel** 0223 65195

**Cornwall**
Brochmark [illegible]
[illegible]
[illegible]
[illegible] Road
St. Austell PL25 5BG
**Tel** 0726 10208

**Dublin**
Lendac Data Systems Ltd
8 Dawson St
**Tel** 0001 372052

**Glasgow**
Byteshop Computerland
Magnet House
[illegible] St. G2 7NH
**Tel** 041 221 7409

**Leeds**
Hewart Ltd
Manchester Unity House
1-12 Park [illegible] Row
Woodhouse
**Tel** 0532 458459

**London**
Byteshop Computerland
48 Tottenham Court Rd
W1P 9TD
**Tel** 01 636 0647

Digitus
9 [illegible] Street
Covent Garden WC
**Tel** 01 405 6976

[illegible]
[illegible] Road
[illegible]
London SE
**Tel** 01 672 [illegible]

**Manchester**
Byteshop Computerland [illegible]
Gateway House
Piccadilly Station Approach
**Tel** 061 236 4737

NSC Computers
29 Hanging Ditch
**Tel** 061 832 2269

**Newbury**
Newbear Computing Store
40 Bartholomew St
**Tel** 0635 30505

**Nottingham**
Byteshop Computerland [illegible]
4 A Lower Parliament St
NG1 3LF
**Tel** 0602 40576

**Sheffield**
Hallam Computer Systems
45 [illegible] Road S11 9PN
**Tel** 0742 [illegible]

**Southampton**
[illegible] Systems
[illegible] Cumberland Place
SO1 [illegible]
**Tel** 0703 38740

**Sudbury**
[illegible]
[illegible]
[illegible]
**Tel** [illegible]

**Warwicks**
[illegible] & [illegible]
[illegible]
[illegible] Square
[illegible]
**Tel** [illegible]

**Watford**
[illegible] Computer Services
[illegible]
High Street
Watford WD1 [illegible]
**Tel** 0923 [illegible]

Comart Microcomputer dealers are located strategically throughout the country to give support, guidance and assistance in the event of difficulty contact Comart direct

# comart communicator

The clean simplicity outside...

...conceals the pedigree inside.

Comart's CP100 Communicator is the new British designed British made Microcomputer from Comart. It is the result of a carefully conceived development programme. It exploits Comart's first hand experience of the British computer market, and their growing strength as a manufacturer.

CP100 is the first of a new generation of flexible expandable micros specifically developed to suit British operating conditions and communication requirements.

The clean lines outside conceal the power within: its S-100 bus means wide ranging peripheral support, and simple after sales care. And that's not all! Communicator is built to keep your future options open. It's ready for Prestel asynchronous and synchronous operation. It has expandable memory capability and yet it's price competitive as a stand-alone system with its CP/M™ operating system and support software.

Find out more about Communicator today.

The U.K. Leaders in Microcomputer
Development, Application and Support

**comart**

St Neots HUNTINGDON Cambs PE19 2AF
Tel (0480) 215005 Telex 32514 Comart G

NORTH STAR BUSINESS SYSTEM

WORD PROCESSING
STOCK CONTROL
INVOICING
SALES & PURCHASE LEDGER
ETC ETC

FREE CP/M & WORDSTAR

EX-STOCK

PROVEN RELIABILITY
1 YEAR GUARANTEE

**Word Processing System**
H[illegible] r [illegible] RAM, [illegible]
T[illegible]
N[illegible] ter wi[illegible] ical track
Package price (including all cables) £4450.00
FREE!! WORD[illegible]AR plus C[illegible]M with above system
Package price with WordStar customised keyboard £ 70.00
Pa[illegible] th [illegible] aci y dr[illegible] CP M £ 300 00

**INVENTORY System**
Horizon computer (64K RAM 2 D D drives)
Televideo TVI [illegible] VDU
Anadex [illegible] P 9500 Printer 150 cps logic seeking
INVENTORY [illegible] with S[illegible]d Purchase Management
P[illegible] £3845 00
P[illegible]ge [illegible] £ 280 [illegible]
Package price wit[illegible] p nwr[illegible] rac r [illegible]

**Mini floppy Timesharing System**
Ho[illegible] r [illegible] qua capa ity [illegible]
Anadex [illegible] 95 [illegible] ter
Switchboard 2 [illegible] 2 [illegible] card with 4K RAM
Mic[illegible] Mikes Release [illegible] Timesharing Package
Pa[illegible] al cables) £3545 00
Pa[illegible] NE[illegible] RO [illegible] £ 880 00

**Hard Disk Timesharing System**
[illegible] 64K RAM [illegible] capa ity drives)
[illegible] Pri[illegible]
Swi[illegible] wi[illegible] RA 1
Morrow 2[illegible] Mb Hard disk package Micr[illegible] Mik[illegible] Star Share
Package price (including all cables) £6795 00
Package price with NE[illegible] RO Spinwriter [illegible] tractors £ 880 00

*PLEASE WRITE OR PHONE FOR LATEST PRODUCT CATALOGUE*

[illegible] SERVICES
[illegible]
OTEK
[illegible] 82
LTD
[illegible] el 0443-4084
DEVICES LTD
[illegible] 3 [illegible] 77
M
Tel 0 [illegible] 2954
[illegible] SOFTWARE COMPA[illegible]
[illegible] 01 722 8435
STEMS LTD
Te[illegible] 01-[illegible] 9006
[illegible]TED SERVICES LTD
Tel 0752-828 [illegible]84
SERVICES
Te[illegible] -236 8323
[illegible]IR SERVICES
[illegible] el 0222-3843 3
[illegible]TER SERVICES
0206-27228
[illegible]PUTER SERVICES
[illegible] 0932[illegible]2048
[illegible]N COMPUTER SERVICES L[illegible]
[illegible]m Lincs [illegible] 0476-72000
FACILITIES LTD
T[illegible] 01 979 4646
[illegible]YS LTD
[illegible]erseyside Tel 05[illegible]-42873
COMPUTER SERVICES
[illegible] 01 256 220 [illegible]
[illegible]
Sussex Te[illegible] 0293-51 201
[illegible]RE SYSTEMS
[illegible] Essex 02[illegible] 74 57743
[illegible]POT COMPUTER SYSTEMS LTD
Doncaster Te[illegible] 0302 60833
STAG TERMINALS LTD
Teddington Middx T[illegible] 0[illegible] 943 0777
SUMLOCK BONDAIN LTD
London EC1 T[illegible] 01 250 0505
TANTUS MICROSYSTEMS LTD
London SW15 [illegible] 1 788 5064
VIDEO VECTOR DYNAMICS LTD
Glasgow S[illegible] 041 288

INTERAM

UK Distributor
**INTERAM** Computer Systems Ltd
59 Moreton Street,
Victoria London SW1V 2NY
Tel 01-834 0261/2733
Telex 925859

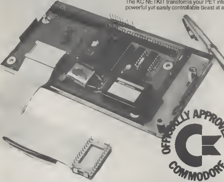
# THE KC NETKIT

## AN ACTIVE INTELLIGENT INTERFACE FOR EASY PET COMMUNICATION.

The Kingston NETKIT, a British designed and developed product is more than an interface, it is a hardware/firmware package that dramatically widens the scope of the PET

- The Netkit consists of interface hardware and 2k of machine code
- Permits high speed exchange of programs and data between a PET and any other RS232 interface (up to 4800 Baud)
- Allows the PET to be linked to a wide range of fast and slow printers, time sharing systems etc
- Transforms the PET into a smart or dumb terminal, allowing the PET to be externally controlled for all functions
- Easy to use, no complicated machine code for input
- Gives full character conversion Useful in programming and in driving remote devices such as paper tape punches for creating high speed telex or NC machine tape
- Share processing and programming
- Reads ASCII files into PET basic
- Gives ten new SERIAL BASIC commands
- Easy to install inside the PET Installation instructions and detailed operating manual included
- 12 months parts and labour guarantee

The KC NETKIT transforms your PET into a more powerful yet easily controllable beast at a low cost



OFFICIALLY APPROVED BY COMMODORE

Your Local Distributor is –

**KINGSTON**

**Ideas and products to extend your system inexpensively.**

Kingston Computers Limited, Electricity Buildings,
Filey, North Yorkshire YO14 9PJ
Telephone (0723) 514141 Telex 52642

A Member of the Dale Group of Companies

K1/1080

# TECHNICAL SPECIFICATION/ APPLICATION

The NETKIT is fitted into a low profile steel case which sits on the memory expansion and is connected to ROM memory through any of the ROM sockets The top of the case is slotted to give access to a memory expansion bus Contact with the outside world is via a 25 pin female D connector which clips into the memory expansion port No external power supply is required

## 1. DOES THE NETKIT MAKE DEMANDS ON RAM SPACE?

If ROM socket 'A' is used then no RAM memory is required otherwise 1 8K of RAM will be called for, however, the economy of SERIAL BASIC commands will quickly repay the RAM memory

The unit can be installed within five minutes The detailed operating manual includes an extensive section on the design and assembly of cables However cables can be supplied

## 2. NETKIT SETS NEW STANDARDS IN POWER AND ECONOMY

The NETKIT with its many features allows applications as diverse as simple printer interfacing to data and task sharing with NETKIT's SERIAL BASIC being an easy to use true high level language

## 3. ON LINE CHARACTER CONVERSION

One feature in the NETKIT is on line conversion of characters A seven and eight bit conversion table is included in the NETKIT's software both of which may be quickly converted by the user to meet his particular needs Useful in representing PET's eight bit set on, or to, a seven bit device Consider what happens when a program involving CHR$ (17) cursor up and CHR$ (145) cursor down, is LISTed to an intelligent printer Both will appear to the device as CHR$ (17) but worse CHR$ (17) is DC1 remote enable The outcome varies from buffer memory clearance to spurious printing The NETKIT provides a sophisticated answer with its !LIST command allowing direct conversion to self apparent equivalents (n)orth (s)outh etc

## 4. LINE TERMINATION

Control of line termination and carriage return is important on for example a printer lacking an auto line feed The presentation of 'overrun sickness dropped or garbled characters is caused by either a printer with a slow head return and limited buffer or the processor re-organising its memory normally remedied by reducing the baud rate whereas all that is necessary is the addition of 10 nuls to each typical 80 Byte string Furthermore there is often only one program in a suite which may have sufficient PRINT content to produce overruns resulting in changing printer settings between programs The NETKIT's capability to add up to 127 nuls automatically to strings is invaluable since it can often virtually double the system's work capacity by running at a high Baud rate

## 5. THE NETKIT AS A BI-DIRECTIONAL RS232(U24) INTERFACE

The EIA RS232 standard is regularly abused providing little more than minimal control By contrast, the NETKIT's lines 1 through 8 and 20 namely GND TXD RXD CTS DSR, DCD DTR, are independently implemented and may be set as required to provide sensitive data control

The normal IEEE Bus makes the CBM PET into a listener rather than a talker with bi-directional communication at a maximum of 600 Baud used with tedious GET looping Since the NETKIT bypasses the IEEE Bus these limitations are overcome and bi-directional communications with speeds as high as 4800 Baud are possible Furthermore the NETKIT offers a wide range of asynchronous speed options from 50 to 19 300 Baud directly selected at any time Additionally the programmable ACIA can operate synchronously with an external clock

The NETKIT offers a wide range of character protocol option with data words from 5 to 8 bits stop and parity bit, being keyboard selectable Parity checking in the PET/ RS232 interfacing is normally difficult to achieve The NETKIT remedies this by offering an optional failure indicator CHR$ (166) graphic grey which can be used to highlight validation

## 6. WHAT IS ACTIVE INTERFACING?

The NETKIT's SERIAL BASIC commands !ON and !CLOSE allows a programmer to double his processing power with a second PET without totally rewriting his suite of programs or buying new peripherals by using the keyboard to pass over SERIAL and STANDARD BASIC commands i e by writing a short break in subroutine which first requests the second machine to stop what it is doing acknowledge receipt of the interrupt and wait for further instructions Once the acknowledgement is received virtually any command sequence can be transmitted, including a request for relaying back of information Finally, when the business is completed the second unit is set back into its prpgram by simply !PRINTing a CONT to it.

The PET cannot identify the source of any instructions, therefore any device capable of transmitting BASIC like strings will serve Thus anything from a keyboard printer to a mainframe can take over temporary or permanent external control of a PET

## 7. PROGRAM TRANSFER TO AND FROM THE PET

The new SERIAL BASIC commands !LIST !LOAD and !READ, allows programs to be transferred to and from external devices and at the same time provide a useful tool in rapid tailored program assembly by MERGING prefabricated modules into an existing framework e g the program is LISTed as an ASCII file then !LOADED into a buffer area in the receiving PET immediately behind any existing program and finally !READ from the buffer and MERGED with the current file

Not only PET to PET transfer is possible as virtually any device capable of issuing an ASCII LISTing will LOAD e g from paper tape cassette disc a terminal or even a modem

## 8. THE PET AS A TERMINAL

A PET fitted with a NETKIT can be called into terminal mode at any time using the !OPEN command with four optional statuses, namely half or full duplex with or without a cursor Half duplex with cursor gives current entry echoed directly on the terminal screen with next point of entry, defined by the cursor

Full duplex with cursor gives current entry (either converted characters or actual) on both the host and terminal screen The majority of specialist terminal requirements can be met by a PET upgraded with a NETKIT and to this end we provide as much information as we are able in our manual to assist the user with these and other applications such as linking to MAIN FRAMES etc